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NEW YORK, SATURDAY, JUNE 27, 1903.

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.

THE RAILROADS AND THE NEW EAST RIVER BRIDGE.

In a few months' time the East River Bridge will be completed and at the disposal of the traveling public, to meet whose pressing needs this great structure was projected. Like all our public works, it is years behind the time set for its completion, and, therefore, its long-delayed opening would, under ordinary circumstances, be doubly welcome. Unfortunately, however, the question of the utility of the bridge is ultimately dependent upon the co-operation of the street and surface railroads, both in Manhattan and Brooklyn, for whose accommodation the greater part of the space on the bridge has been reserved. No bridge with a floor space approaching that of the new East River Bridge has ever been built, and there is provision for four street railroad tracks and two elevated railroad tracks; this provision being made under the very natural expectation that long before the bridge was completed the various railroad companies would make application to the city for the right to use these tracks at a stated rental. Nothing of the kind, however, has occurred, and to-day the companies are as mute upon this question as though they were unaware that a new East River bridge had been even so much as suggested; or if the matter is mentioned, the railroad companies seem indisposed to make connections across the bridge except at a rental which is purely nominal, and an altogether inadequate return for the great advantages to be derived by the company from this means of interborough connection.

There is a growing conviction among the city officials and the general New York public that the railroads are purposely holding back in the expectation that the city, weary of waiting, and prompted by the urgency for improved communication, will allow the railroads to use the bridge for practically no rental whatever. In view of the large number of valuable franchises that have been practically given away during the past fifty years of the city's life, franchises which to-day should be yielding a princely revenue to the city itself, it goes without saying that a firm stand should be taken in the present case; and we think that the very successful manner in which the city operated its own railroad across the Brooklyn Bridge will fully justify it in laying its own tracks across the bridge and operating them by a system of electric cars run upon the shuttle or the loop system. In the case of the Brooklyn Bridge the city ran the bridge cable roads itself, and was able to show an annual profit on the operation. By laying four tracks across the bridge, the city would be able to put the bridge in full operation on the day on which it is open, and could to that extent be independent of any attempt on the part of the railroad companies to force its hand. It is true that the tracks that are all laid down Delancey Street belong to one of the transportation companies, but there is nothing to prevent the city from laying its own tracks parallel with these upon that portion of the street which is available when the widening of Delancey Street has been accomplished.

PAINTING BY THE ACRE.

Only those who are directly concerned in the operation of a line of steamships have any idea of the enormous total cost of operation of even a single ship, and of the extraordinary variety of the sources from which expense bills are made up. Of course, the main items of expense are perfectly familiar even to the person who takes but a languid interest in a steamship; we all know that the coal bill is a big one, and that on a great passenger steamer the single item of wages runs up to very large figures, while, of course, the bill for provisions and general stores is also a considerable item. Outside of these, however, there are other less-considered sources of expense, one of which, the painting of a ship, is very cleverly treated in an article which we publish in the current issue of the Supplement, showing that this single item in the maintenance of the fleet of one corporation runs annually into hundreds of thousands of dollars. So great is the size of a modern transatlantic liner that the total area to be covered every time she is painted runs up into the acres. Thus we learn that to entirely paint the top sides of a big steamship from water line to rail calls for enough paint to cover about an acre of surface. About as much more is required to paint the upper works, while the big smokestacks call for over half an acre of paint, and in the case of the German steamships with four smokestacks, the total area must be nearer three-quarters of an acre. Since the great ships of the first-class companies are painted every voyage, the calculation shows that to keep the one hundred or so vessels of the International Mercantile Marine Company in first-class shape requires the painting of some 2,250 acres each year at a cost of between one-quarter and one-half million of dollars. A curious fact in this connection, which is a direct compliment to our climate on this side of the water, is that on account of the larger number of fine days on the eastern seaboard of the United States, the painting of the vessels is almost invariably done on this side of the water, even in cases where the headquarters of the company are in some English or Continental port.

RAILROAD TIES AND OUR FOREST SUPPLY.

The renewal of wooden railroad ties on the 200,000 miles of railroad track in the United States causes an enormous drain upon the forest resources of this country. The hardwood ties used in the Eastern States of a road with fairly heavy traffic have a life of only a few years, and the softwood fir ties used on the middle, western, and southern roads have a useful life lasting only half as long. When we remember that the average number of ties to each 30-foot rail is sixteen, it is easy to compute that the total number of ties on all the railroads is about 35,000,000, and that if the average life of the tie is five years, there must be needed for renewals about 7,000,000 ties yearly. The average size of the tie is about 6 inches in depth by 8 inches in breadth and 9 feet in length, and consequently in each tie there is about 36 linear feet of timber. Hence the total annual renewals throughout the United States must call for the delivery of over 250,000,000 feet of sawed or hewed timber. Allowing one-third for waste, there must be some 330,000,000 linear feet of timber cut annually from our forests to supply this one item of railroad ties.

In view of these facts particular interest attaches to the statement that the Great Northern Railroad has adopted in place of the ordinary 6x8 tie of rectangular cross section, a tie of triangular section with a face 12 inches in width and a depth to the apex of 7 inches; for in the first place it is evident that there will be a great economy of material in using a tie of a section so much smaller; and it will be seen that there is also an economy due to the use of a tie with a broader face, since a smaller number will be required to the rail. The ordinary 6 x 8 tie has a total cross-sectional area of 48 square inches, whereas the sectional area of the triangular tie is 42 square inches, which in itself means a saving of 4½ linear feet in each tie. One of the most important functions of the tie is to increase the ultimate bearing surface of the track system upon the ballasted roadbed, and, of course, the increase in the width of the tie from 8 to 12 inches means an increase of bearing surface of exactly 50 per cent. Consequently the number of ties per mile may be reduced over one-third without any loss of total bearing surface. Probably no such reduction as this will be made, for the reason that the transverse strength of the triangular tie is not equal to that of the square tie, and the transverse strength has, of course, to be considered. There is a further and incidental advantage in the triangular section, due to the fact that there is a wedging action of the tie when it is under load, tending to make it embed itself more securely in the ballast. In other words, it is to a certain extent self-tamping, adjusting itself in the ballast automatically, and saving a certain amount of oversight and labor on the part of the section gangs. It seems that the new type of tie has passed the experimental stage, since it has been in use in the terminal yards of the Great Northern Railway at St. Paul for several years past, where it is claimed that it has shown itself to be more effective under heavy service than the conventional type. If the same results are shown in main line service under fast and heavy traffic, this very simple expedient will prove to be one of the most radical and beneficial that has been introduced into American railroad practice for many years past.

THE NEW 13,000-TON BATTLESHIPS.

The plans of the two new 13,000-ton battleships, the "Idaho" and "Mississippi," recently authorized by Congress, which have been approved by the Secretary of the Navy, call for two very powerful but relatively slow vessels, the trial speed being placed at from 16½ to 17 knots. This is several knots slower than the battleship speed adopted for some of the newest warships building for other navies, a disparity of which we shall have something further to say later on. The sacrifice of speed has enabled the Naval Board of Construction to give these battleships armor and armament but slightly inferior to that of the big 16,000-ton "Connecticut" and "Louisiana." They will carry four 12-inch guns, in turrets forward and aft; eight 8-inch guns in four turrets at the corners of the central battery, ten of the new 7-inch guns mounted in broadside within this battery, and twelve 3-inch, six 3-pounders, four 1-pounders, besides ten smaller guns. In order to carry this heavy armament other sacrifices besides those of speed had to be made. Thus the after military mast is dispensed with, and the freeboard aft is reduced by 8 feet, the outboard profile of the vessels corresponding very closely to that of the battleship "Maine." The side armor, moreover, is only 9 inches in thickness and the coal supply is limited. Of course, the adoption of these plans was not arrived at in the Naval Board on Construction without the usual controversy between the Bureau of Steam Engineering and the Bureaus of Ordnance and Construction. Admiral Melville has always been a strong advocate for high speed both in battleships and cruisers, and although this may be attributed in part to the natural desire of any particular Bureau in the Board on Construction to secure as large an allotment of displacement as possible, still we cannot but feel that, judged on the broader grounds of national expediency, it is a mistake in designing such powerful and costly ships to limit their efficiency by a return to the battleship speeds of ten or twelve years ago. We have no doubt that the compromise was considered to be the best possible under the limitations of cost imposed by Congress, and we suggest that the best way out of the difficulty would be for the next Congress to increase the appropriation for these two ships sufficiently to allow of an increase in displacement to admit of engines and boilers capable of giving them a speed of not less than 18 knots an hour. When the appropriation for these vessels was first made, it was proposed to make them conform in design to the "Maine" class so that they would form a part of a homogeneous fleet of five vessels. Now, however, they conform neither to the "Maine" class nor to the "Louisiana" and "Connecticut." By an increase of a knot in the speed, these ships could at once be brought closely up to the standard of the "Louisiana," and with the three 16,000-ton battleships "Minnesota," "Kansas," and "Vermont," contracts for which have just been let, they would form a splendid fleet of seven battleships of practically similar speed and power.

"SHAMROCK III." IN DRYDOCK.

When the underbody of "Shamrock III." was revealed in drydock at the Erie Basin, it was evident that she corresponded very closely with the description furnished by our Glasgow correspondent at the time of her launch. Of course, the view then had of the yacht was obscured considerably by the double pontoons in which she was launched, and it was not until one had an opportunity to look her over in drydock that a just appreciation of the undeniable beauty of the boat could be had.

"Shamrock III." is a marked departure, in some respects, from any challenger that has been sent over from the other side for many years past. We have to go back to "Valkyrie II." to find a midship section that bears any similarity to the easy bilges and full garboards that distinguish "Shamrock III." so sharply from any of her immediate predecessors, and in this respect she is the most "wholesome" yacht of any of the existing challengers and defenders of the 90-foot class. Having said this much, it has to be admitted that all the other characteristic features of the boat are marked by the extremes of beam, draft, and overall length to which designers have been driven in their attempt to carry a maximum amount of sail under a rule which, unfortunately, puts no limit whatever upon sail area—an unfortunate omission, to which more than anything else is to be attributed the absurdly exaggerated proportions of the modern racing 90-footer. The over-all length of "Shamrock" is close to 140 feet, the waterline length slightly under 90 feet; beam about 25 feet, 6 inches—not 22 feet, 6 inches, as reported by a cablegram sent out by the builders of the boat; draft in racing trim 21 feet, and her displacement in the neighborhood of 150 tons. Although her midship section is large, the lines, which have been carried out with the skill that characterizes all the Fife boats, are so sweet and fair that she looks at first glance more like a 70-footer than a boat built up to the full 90-foot limit. The sections throughout are round and fair, free from sudden changes of curve or "humps." "Round as a barrel" is a term that may justly be applied to "Shamrock III." She should show small initial stability—a valuable feature when the wind is light and the sea troubled—while her deep and easy bilges will give her great sail-carrying power when she is heeled to her best sailing lines. The boat will be comfortable in a seaway, and she will do her best work over the windward and leeward course. Her deep midship section will be a drawback to the boat in reaching, especially when the higher speeds are attained and wave-making begins, and on this point of sailing "Reliance" will probably have no difficulty in leaving her. To windward, judged purely by their models, "Shamrock III." should be the better boat; but "Reliance" has shown such unexpectedly good windward qualities that it is likely that she will be able to hold her on this point of sailing and possibly pull away from her. Before the wind, under spinnaker, "Shamrock III.," because of her smaller wetted surface, should be the more slippery boat; but, on the other hand, the enormous sail plan of "Reliance" will probably outweigh her greater wetted surface, and pull her down to the leeward mark some minutes ahead of her more handsome sister.

The sail plan of "Shamrock II." was found to be so pre-eminently satisfactory that it has been adopted with very little change in "Shamrock III.," the later boat carrying about a couple of hundred more square feet of sail. The mast is 158 feet in length, and the boom 104 feet, with a base line of 78 feet for the forward triangle. The rig is thus, relatively to "Reliance," narrow for its height and favorable for windward work. The question now is whether the deeper-bodied, rounder, and sweeter boat, with her generous sail plan of 14,400 square feet, can hold her own with a flat-floored, shoal, full-bowed boat carrying fully 1,500 square feet more canvas. It is a clear case of a gamble on the weather, with the odds largely in favor of the overgrown boat. In winds that will allow "Reliance" to carry her sailspread, we think there is not a doubt as to the outcome; but should the wind pipe up to a strength of 20 to 25 knots, we prophesy dire trouble for the scow and a good fighting chance for the smaller boat.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The brightest and most interesting regions in the evening skies of July lie to the eastward of the meridian. The Milky Way, rising obliquely from the north point of the horizon, sweeps round in a vast curve to the eastward of the zenith, and descends toward the south. Along it we find a series of brilliant constellations. Beginning low in the north, we first find Cassiopeia—familiar at all seasons, for in our latitude it never sets. Next above, on a level with the pole star, a few rather inconspicuous stars mark the place of Cepheus.

Though this group hardly adds much to the brightness of the sky, the next one makes up for its deficiency, for it is the splendid constellation Cygnus. This is one of the few groups of stars that bear any resemblance to the objects for which they are named. It takes but little imagination to see the head and body of a flying swan in the line of stars that lies almost centrally in the Milky Way, and its outstretched wings in the equally conspicuous line that crosses it.

The southernmost of the principal stars of the constellation—Beta Cygni—which marks the tail of the swan, is well worth looking at with any telescope, however small. It is one of the finest double stars in the heavens, though a very wide pair, and is an admirable example of contrasted colors, the principal star being orange, and its companion blue. The two stars have a common proper motion in space, and it is not unlikely that they are also in revolution around one another, though the period must be many thousands of years, as the stars have shown very little relative motion in the last century. Their distance from the earth is very great—too great for accurate measurement—so that we can only say that the system must be one of enormous magnitude, so great that the sun, or even Sirius, if set alongside it, would seem small in comparison.

Close to Cygnus, and on the western edge of the Milky Way, is Lyra. The brilliant Vega marks this constellation so conspicuously that it is one of the easiest of all to recognize.

Below Cygnus the Milky Way divides into two branches, which pursue a roughly parallel course as far as the southern horizon. The western branch is comparatively faint, but the eastern one contains the brightest part of the galaxy that we ever see, and is full of intricate patches and knots of brightness, and also of dark holes and pockets, some of a most extraordinary character. One of the most conspicuous is in Cygnus, and looks almost as if a dark streak of cloud obscured the stars.

Not far below Cygnus, in this branch of the Milky Way, lies Altair, a first-magnitude star, and one of our nearer neighbors. There are no very bright stars lower down, though the little inverted "milk dipper" in Sagittarius is a characteristic configuration, but the galaxy itself is here fine enough to reward observation abundantly.

West of Sagittarius, and right on the meridian, Scorpio is in full view, from the three stars which mark his claws and the red Antares in his body down to the recurving end of his upturned tail. It is a pity that we never see this constellation at a greater altitude, clear of the mists of the horizon, for it is one of the finest in the heavens.

There is little of interest east of the Milky Way. Pegasus is just rising below Cygnus, and Capricornus is partly visible below Altair.

The planet Saturn, which is about an hour high in the southeast, is the brightest object in that part of the sky.

On the meridian are Draco, above the pole, Hercules, almost overhead, and Ophiuchus, stretching southward toward Scorpio. Virgo and Boötes are farther west, and their principal stars, Spica and Arcturus, are the chief adornments of the western sky. Mars is near the former, but is not very conspicuous.

Leo, which is just setting, and Ursa Major, which fills the space to the left of the pole, complete the list of the constellations now prominent.

THE PLANETS.

Mercury is morning star until the 25th, when he passes through superior conjunction, behind the sun, and becomes an evening star.

He is rather higher than usual and easily seen during the first ten days of the month. On the 1st he is in Taurus, not far from Aldebaran, and rises at about 3:30 A. M., an hour before the sun.

Venus is evening star and is very conspicuous. On the 9th she reaches her greatest eastern elongation, being 45½ deg. from the sun. As she is moving southward, however, she does not remain in sight quite as late as she did in June. On the 1st she sets at 10 P. M., but on the 31st at about 9 P. M. She is moving eastward through Leo and Virgo during the month, and passes close to Regulus on the 16th—within a degree of him. Her phase changes from a half moon to a pronounced crescent during the month, but her decreasing distance, and increasing apparent diameter, more than make good the deficiency, so that she is growing brighter.

Mars is evening star in Virgo. On the 6th he is in quadrature with the sun, and comes to the meridian at 6 o'clock. He is rapidly receding from the earth, and is only one-quarter as bright as he was at opposition in March. As he moves eastward through Virgo he passes quite near Spica, their least distance, 1½ deg., being reached on the 23d.

Jupiter is in Aquarius and rises about 10 P. M. on the 15th. He is the most conspicuous object in the morning sky, but it is still too early to observe him comfortably in the evening.

Those who can command good telescopic aid, and who are interested in watching his satellites, will be repaid for the trouble of looking at him on the nights of the 22d and 29th, for on both these occasions the planet appears for some time with only one visible satellite—the fourth. On both nights the first satellite is in transit in front of the planet, and the second and third are behind it, or eclipsed in its shadow. The succession of phenomena—ingress of one satellite, egress of another, occultation of a third, etc., occupies the whole night, but the most interesting hours of observation are from 11 to 1 in both cases.

Saturn is in Capricornus, and comes to opposition on the 30th. He is still very far south, but is a little better placed than last year. In spite of his low altitude he is a most interesting telescopic object. The smallest instrument will show his rings, and his brightest satellite, Titan, whose motion round the planet, completed in a period of 16 days, is interesting to watch. A larger instrument brings out the smaller satellites nearer the planet, as well as the outer one, Iapetus, which is about three times as far away as Titan, and takes 80 days to complete its circuit.

Uranus is in Ophiuchus, and comes to the meridian at 10 P. M. on the 15th. Neptune is morning star in Gemini—too near the sun to be observed.

THE MOON.

First quarter occurs at 4 P. M. on the 1st, full moon at 1 P. M. on the 9th, last quarter at 2 P. M. on the 17th, new moon at 8 A. M. on the 24th, and first quarter once more at 2 A. M. on the 31st. The moon is nearest us on the 24th, and most remote on the 10th.

She is in conjunction with Mars on the evening of the 1st, Uranus on the 7th, Saturn on the 11th, Jupiter on the morning of the 15th, Neptune on the 22d, Mercury on the 24th, Venus on the 27th, and Mars again on the morning of the 30th.

The most noteworthy of these conjunctions are those with Jupiter and Mars, which are quite close, especially the first conjunction with Mars. In fact, an occultation of the planet is visible from the southern parts of the United States on July 1, the hour verging from 8 to 9 P. M. Eastern Standard time, according to the location of the observer. As seen from New York, Mars will only make a close approach to the northern limb of the moon.

Cambridge, England.

SCIENCE NOTES.

The Great Salt Lake of Utah is gradually drying up. Readings taken by United States Section Director Hyatt show that the lake level, despite heavy rains, is 2 feet, 6 inches below the normal.

Before the Chemical Congress at Berlin, on June 7, Prof. W. Markwald exhibited specimens of polonium. A bit of the metal was shown weighing 0.15 of a grain, which was produced from two tons of uranium at a cost of $75.

Andrew Carnegie has purchased the famous zoological collection of Baron de Beyet, of Brussels. The collection is especially rich in specimens of extinct birds of central Europe and northern Asia. The collection is to go to Harvard University.

The temperatures of the stars are given as follows in the Report of the International Congress of Physicists of 1900:

Star.	W.L.	T°	t°
The Sun	0.54	5450	4850
Sirius	0.46	6400	5700
Vega	0.46	6400	5700
Arcturus	1.08	2700	2450
Aldebaran	1.03	2850	2550
Betelgeux	0.94	3150	2800
Electric Light	0.84	3500	3150

W. L. is the known wave length of the wave of maximum energy; *T*, *t* are the limits between which the absolute temperature must lie.

In the early history of Virginia and Maryland tobacco was by all odds the most important crop, and it was even possible at times to secure a wife in exchange for a moderate amount of tobacco, as in later days in the West a squaw could be obtained in exchange for a small amount of whisky. In 1732, at Jamestown, tobacco was made a legal tender for all debts, including customs. In about a dozen years after the founding of Jamestown by Capt. John Smith, an English nobleman, Sir Edwin Sandys brought over with a shipload of supplies ninety young English maids, who, immediately upon their arrival, were wooed and married by the colonists, each being paid for at the rate of "120 pounds of good tobacco." As late as 1777 the annual poll-tax of Baltimore city and county was fixed at 172 pounds of tobacco. Tobacco, it is well known, was a native Indian crop in America before the advent of Columbus.

With their little red wrappers decorated with black polka-dots, the various members of the lady-bug family are gay and attractive members of the insect world. They are always man's friend, and get most of their living by preying on the destructive soft-bodied plant lice, the most common of which is the green aphis, which can commonly be found on house plants and rose bushes. The most striking example of the usefulness of the lady-bug to the horticulturists is seen in the case of *Vedalia cardinalis*, the bug which was imported from Australia and which saved the citrus trees of California by destroying the cottony-cushioned scale which was devastating the orange and lemon groves. In the study of the grain aphis it was found that a species of lady-bug preyed upon this pest. The former were observed to go down among the roots of the grain in the field in search of the aphides, and to pass the winter along with them in that situation. The larvæ of the lady-bug also live principally upon insects which are destructive to garden and field crops. The dainty lady-bug should never be destroyed.

In a note in Science Dr. Sidney Reeve presents in a brief form the views respecting the dissipation of energy set forth in his book, "The Thermodynamics of Heat Engines." In discussing the second law of thermodynamics he says: While any given quantity of energy tends, so long as it exists without transformation, to fall in intensity and never the reverse, yet the secondary form of energy into which that quantity may at any time find itself transformed possesses a degree of intensity that is entirely independent of that of the original quantity, and which is the maximum permitted by circumstances. In other words, energy tends downward in intensity during untransformed existence and upward during transformation. This necessarily denies *in toto* the doctrine of the dissipation of energy and affirms, on the contrary, that as much exaltation of energy as depression is constantly going on. In short, the total fund of intensity or availability of the energy of the universe is as constant as is the universe's total fund of mass, or as is its total fund of the product of the two, energy itself. The availability of the energy of the solar system is, of course, being steadily dissipated. But astronomy has long since passed the point where observations confined to the solar system suffice for the establishment of fundamental principles of this sort. The old doctrine of the dissipation of energy necessarily excluded any possibility either of the universe being infinite or eternal in its extent, or of its being one with the solar system. The new statement is not only consistent with such views, but it implies them.