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## BIGGEST IN THE WORLD.

Is it because we never entirely lose some of the strong characteristics of childhood that, in describing an event or an object, we seem to consider that the last touch of dignity and importance has not been put upon it until it has been designated as the biggest or most superlative something or other of its kind in the world? It is really surprising how much heart-burning may be caused by a journalistic inadvertency, actual or supposed, in placing the coveted honor where it does not belong. A curious instance of an imagined injustice of this kind has lately reached the Editor's desk in the form of an editorial from our esteemed contemporary, The Daily Eagle of Poughkeepsie, N. Y., in which the writer takes us to task for having stated that the new double-track railway viaduct over the Des Moines River, Iowa, is in some respects the most notable railway viaduct in existence. This structure is 2,685 feet in length, and its rails are 185 feet above the water. The peace of mind of our Poughkeepsie contemporary has been rudely disturbed by our stating that this structure, "in point of the total weight of metal employed in its construction, is fully three times as heavy as the next largest bridge of the kind in the world." The statement is unpardonable in the eyes of our critic, who hastens to remind us that he lives beneath the shadow of a double-track railway bridge, which is 6,767 feet and some inches in length, and 212 feet above high tide, and contains a dead-weight of over 21,000 tons of steel as against the insignificant total of 5,680 tons that was built into the structure over the Des Moines River. The trouble with our contemporary is that he is comparing two horses of an entirely different color, namely, a viaduct and a cantilever, the Des Moines crossing being of the first and the Poughkeepsie crossing of the second type. In bridge engineering parlance it is customary to classify a bridge according to the predominant feature thereof. In the case of railway bridges, such as the Loa viaduct in Bolivia, and the Kinzua and Pecos viaducts in this country, where by far the greater part of the crossing is made up of short spans carried on steel bents or braced towers, with or without a truss span thrown across the main channel, or gorge, as the case may be, the structure takes its name from its predominant feature and is known as a viaduct, this term being generically applied to any tower-and-short-span structure of the kind described. On the other hand, a bridge of the character of the Forth cantilever structure in Scotland, or the Poughkeepsie crossing of the Hudson, in which the cantilevers form the predominant feature and the viaduct approach, great as it may be, is entirely subsidiary, the structure is generically known as a cantilever bridge. The same may be said of the new East River bridge, which, although it is approached by a viaduct several thousands of feet in length—of an aggregate length indeed much greater than that of the suspended structure—will nevertheless be known as a suspension bridge. For all its 4,000 and more feet of viaduct, the splendid structure at Poughkeepsie will ever be known as one of the great cantilever bridges of the world.

## EXTRAORDINARY SPEED IN THE PARIS-BORDEAUX AUTOMOBILE RACE.

From Paris to Bordeaux by road is a distance of 348 miles, and when the great chauffeur Charron covered this distance in the race of 1900 in 11 hours 4 minutes and 20 seconds, at an average speed of 31.4 miles per hour, it was justly considered to be a most remarkable performance. This year, however, has witnessed a feat which is not only the most sensational in the annals of automobilism, but one of the most remarkable speed performances of any kind whatsoever, whether by road, rail or sea; for the same distance was covered by the winner in 8 hours 44 minutes and 44 seconds, at an average speed of about 40 miles an hour. The significance of this performance is only understood when we bear in mind that the Paris-Bordeaux course involves a reduction of running speed to about 7½ miles an hour in passing through ten different towns and cities along the route. If the 18 miles on which there is a speed restriction be deducted, we find that Fournier covered 330 miles in 6 hours 11 minutes and 44 seconds, at an average speed of more than 53 miles an hour. Remembering that in climbing the hills and on certain parts of the road where curvature or other local conditions would necessitate it, the speed must have been brought down very much below this average, we can see that, on certain stretches, the automobile must have been running at a speed of from 70 to 75 miles an hour—and this, be it remembered, upon a country macadamized road and not upon a carefully aligned steel track, fenced in from all the risks and dangers of miscellaneous traffic. Interest in this performance centers both in the man and the machine. The latter was a Mors vehicle of 35-horse-power, and, unprecedented as was this capacity, it was excelled in some of the other machines that were present at the starting line, the English automobilist Edge, for instance, being on hand with a 70-horsepower machine, which was disqualified on the ground that the tires, which had been substituted on account of a puncture, at the last moment, were of French and not of English make. The machine thereby failed to meet the conditions of the race, which demanded that each machine should have an absolutely national character. Judged on purely technical and mechanical grounds there is, of course, no reason why an automobile provided with sufficient horsepower should not maintain such high speeds and even higher speeds for as great and greater distances; and we say this without wishing to detract from the great credit which is due to the builders of the leading vehicles, several of which made better time than that accomplished by the winner of last year's race.

The most remarkable feature of the whole performance is the nerve and skill possessed by the chauffeur Fournier, for at the terrific pace achieved, it is evident that the slightest error in judgment could easily have precipitated disaster. Full details of the race will be read with considerable interest, particularly as regards the special policing, which must surely have been carried out at crossroads and elsewhere to maintain some kind of a clear track ahead of machines that were sweeping along at speeds faster than those of the average express train. Fournier is well known in this country. Only a couple of years ago he was a conspicuous figure upon the bicycle track at Madison Square Garden, where he exhibited a motor-cycle and introduced motor-pacing to the American public.

It is noteworthy that the leading automobiles were all heavy vehicles of great power, the first five being in the class weighing over 1,430 pounds. The winning machine was, as we have said, a Mors, and the second, third, fourth and fifth were Panhard vehicles. The sixth and seventh contestants to finish were 8-horsepower De Dion motor-cycles, the first covering the distance in 8 hours 1 3-5 minutes and the second in 8 hours 3 minutes. An average speed of over 40 miles an hour for 330 miles for a motor-bicycle is a scarcely less remarkable feat in its way than that of the winning machine.

## THE LESSON OF THE RECENT FERRYBOAT DISASTER.

It is to be feared that the relatively small loss of life in the recent ferryboat collision in New York Harbor, small, that is to say, compared with the loss which might easily have occurred, may result in our too readily forgetting the lesson which this accident teaches. Had the Staten Island ferryboat been rammed by the "Mauch Chunk" when she was far from her berth, instead of being fortunately within reach of shoal water, the list of fatalities would probably have run up into the hundreds.

It is not for us to enter into the question of culpability in this accident: that will be decided by the proper authorities and the blame, if there be any, will be placed where it rightly belongs. Moreover, when we bear in mind the enormous number of passengers carried every year by our ferryboats, the crowded state of the New York waterways, and the fact that the ferryboats make their trips directly across the line of travel of incoming and outgoing ships, we must admit that the freedom from accident is something truly phenomenal and reflects the highest credit upon the skill of our ferryboat pilots. Shipping men from all over the world have commented upon the extraordinary care required in the navigation of the stretch of water that embraces the southern end of Manhattan Island, and have spoken in the highest terms of the skill which is shown by the captains and pilots of our local craft. Having said this much, however, there is one lesson of the "Northfield" disaster upon which we would lay very special emphasis, and this is that in view of the ever present possibility of collision, all ferryboats at the port of New York should be built with a view to their possessing a wide margin of flotation, their hulls being so subdivided by bulkheads that they would be incapable of being quickly sunk, as was the "Northfield," by a single blow beneath the water line. The more modern ferryboats, of course, are constructed on this plan; but there are some of the older boats around New York, which, if they should be run down, would have great difficulty in reaching shoal water before they sank. We trust that one result of this disaster will be the enactment of even more stringent regulations as to the construction and subsequent inspection of all craft employed in the ferry service around this city.

## THE NEW CLYDE LINE STEAMSHIP "APACHE."

It is probably due to the great size and high speed of the transatlantic liners, and the interest of the American public in their performances, that we are in danger of forgetting that our American coastwise steamship companies are adding steadily to their fleets and putting some very serviceable and thoroughly up-to-date new boats upon the various routes. There sailed from this port last week the Cramp-built liner "Apache," the first of two sister ships which have been built by that company for the Clyde Line for service on the route between this port, Charleston, S. C., and Jacksonville, Fla. The "Apache," which is the seventeenth steamship of the company's fleet, is slightly larger than the "Comanche," "Algonquin" and "Iroquois," of the same service. She is 310 feet long, 46 feet beam and 31 feet deep. She is driven by triple-expansion engines with cylinders 25, 43 and 70 inches in diameter and 36 inches stroke, and is built to steam 15 knots when loaded to her full capacity of 3,000 tons of cargo. The staterooms are characteristically American, that is to say, they are spacious, well lighted and airy, and they are free from that too-profuse decoration with which modern passenger ships are apt to be overloaded. There is accommodation for 200 passengers, all of which is above the upper deck.

## RECONSTRUCTION OF GERMAN CRUISERS

The German navy has recently undertaken an important piece of work, which consists in modifying a series of eight cruisers which form part of the fleet so as to increase their tonnage and bring the construction up to date. This is to be carried out in a somewhat novel fashion by lengthening the hull by some 25 feet, cutting it in the middle and adding a central portion. This has already been carried out with the first of the series, the "Hagen," and the results have proved so successful that there is little doubt that the remaining seven will be treated in the same manner. The series of cruisers includes the "Hagen," "Frithjof," "Beowulf," "Hildebrand," "Siegfried," "Heimdall," "Aegir" and "Odin." They are coast defense cruisers which were designed at a period when the German navy was mainly occupied with the defensive, and in consequence these boats, which were to navigate along the coast and keep within a short distance from supply points, carried only a small provision of coal, this being about 220 tons. Their displacement was reduced as much as possible, this being just sufficient to comply with the requirements of this class of boats. Six of these cruisers proved quite satisfactory in service, and gave proof of remarkable nautical qualities, and it was thereupon decided to increase the number from six to eight; the latter two had a displacement somewhat greater than the others, and the power and coal supply was thus increased. However, with the recent increase of the German navy and a new order of ideas, these boats were judged to be quite insufficient to figure in the present fleet. But if their radius of action was limited, their other qualities showed that they were fitted to perform the duties of first class cruisers, and it was accordingly decided to transform them by increasing their coal-capacity and thus add a series of boats to the fleet at a relatively small cost, and as the oldest of these dates only from 1889, they will be still quite modern. To increase the coal capacity, the displacement, and consequently the length of the boat, was to be increased. This operation, which is comparatively easy on an ordinary steamer, presents certain difficulties in the case of an armored vessel; in order to cut it in the middle and add the amount required for the increased displacement, it is necessary that as few of the parts as possible should be dismounted in the two halves, which should be left in their original condition, thus leaving in place the engines and boilers, etc. It was decided to commence the work with the "Hagen," and this was begun at the Kiel docks in September, 1899. The section was made in front of the engines, and the rear part was drawn back about 26 feet; the operation of moving the mass required less than an hour. The intermediate portion which was added represented a weight of 500 to 600 tons. In October, or about a year after the commencement of the work, the "Hagen" proceeded with its trials, with very satisfactory results; the engines and boilers acted well, and developed 5,230 horse power, the number of revolutions being increased to 142 per minute. The coal supply, owing to the increased displacement, has been raised from 220 to 500 tons, and a number of minor changes have been made which give the boat an up to date appearance. The coasting cruisers, when thus transformed, will be able to take an active part with the remainder of the fleet, and there is no doubt that the whole series will be thus treated. To transform the eight vessels will cost about five millions, according to calculations, this representing the cost of a single modern battleship, and the advantage is at once apparent.

### THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The brightest stars in the summer skies are the ruddy Arcturus and the bluish Vega. At 9 P. M. on July 15 the former is some distance west of the zenith, and the latter somewhat nearer on the east. Between them lie the constellations of Corona Borealis and Hercules, the first of which consists of a semicircle of inconspicuous stars, and the second of a keystone-shaped group directly overhead, with outliers on both sides. South of these a large area is filled by the intermingled forms of Ophiuchus and Serpens, whose most characteristic configuration is a kite-shaped figure a little west of the meridian.

Close above the southern and southeastern horizon are Scorpio and Sagittarius. The bright red star Antares, and the long, curving line below it which forms the Scorpion's tail, cannot be mistaken; and Sagittarius, which is anyhow one of the more conspicuous zodiacal constellations, now includes within its borders both Jupiter and Saturn.

Aquila, marked by the brilliant Altair, with a fainter attendant on each side, is well up in the southeast. Below it is Capricornus, whose two brightest stars both show double in a field-glass. Cygnus is conspicuous in the Milky Way below Vega. Farther down on the right is the little group of Delphinus, often called "Job's Coffin." Pegasus and Andromeda are rising in the northeast. Of the circum-polar constellations, Cassiopeia is below and to the right of the pole, Cepheus higher up, Draco and Ursa Minor above the pole-star, and Ursa Major on the left. Leo, Virgo and Libra fill most of the western and southwestern sky.

The present is a good opportunity for the study of some interesting variable stars. First among these may be mentioned Beta Lyrae, which is the nearest to Vega of a pair of small stars which lie on the line joining it with Altair, about one-quarter as far as the latter. The changes of its brightness may be easily observed by comparing it with its neighbor, Gamma Lyrae. They are completed in 12 days 21¾ hours, during which time there are two equal maxima of brightness, separated by two unequal minima. Beginning at the first maximum, its magnitude is 3.4, about equal to Gamma. Then it falls nearly to the fourth magnitude, rises again to its original brightness, and descends once more to the 4½ magnitude, returning finally at the end of the period to its initial condition. The star's spectrum also shows remarkable peculiarities, containing both dark and bright lines, which are periodically displaced with reference to one another in such a way as to show that they are produced by two different bodies revolving about one another in a period equal to that of the light-variation.

The following explanation of the star's variability, deduced from the above-mentioned facts, is taken from an article by Mr. Myers, published some time ago in the Astrophysical Journal. Beta Lyrae consists of two stars, one about three-quarters the diameter of the other, revolving about one another, in a circular orbit, so close together that they almost touch. The plane of this orbit is inclined very little to the line of sight, so that the stars alternately eclipse one another. The smaller star is nearly twice as bright as the larger one.

At the principal minimum, the small star is behind the larger one, and only the light of the latter reaches us. Three days later it is on one side, and the combined light of both stars produces a maximum. After about three days more the small star is in front of the large one, hiding most of it. All the light of the small star and part of that of the large one reaches us, so that, though the star does not appear to us as bright as at maximum, it is much brighter than at the principal minimum. When the small star has moved off on the other side we have a second maximum. The actual velocities of the stars in miles per second can be determined from the spectroscopic observations, and thus it is found that the centers of the two stars are about 30,000,000 miles apart. The larger star is over 30,000,000 miles in diameter, and is about 21 times as heavy as our sun The diameter of the smaller one is about 23,000,000 miles, and its mass nearly 10 times that of the sun. Their bulk, in proportion to their mass, is enormous, so that they must be entirely gaseous and hardly denser than the earth's atmosphere at sea-level.

Two other short-period variables are now in good position for observation. On the upper edge of the Milky Way, about midway between Cygnus and Cassiopeia, is a triangle of small stars. The nearest one to Cassiopeia is Delta Cephei, which varies between the magnitudes 3.7 and 4.9 in 5 days, 8 hours and 48 minutes. The other two stars of the triangle are good "comparison stars."

To find the other variable, start with Altair. A line drawn from the small star above it through the fainter one below it, and continued as far again, bending sharply to the right, points out Eta Aquilae. The period of this star is 7 days, 4 hours and 14 minutes, its maximum magnitude is 3.5, and its minimum 4.7.

The variation of both these stars is of the same type. The brightness changes continuously, rising rapidly to the maximum, and falling off much more slowly toward the minimum. In the case of Eta Aquilae a slight rise to a secondary maximum interrupts the falling phase. Such variation evidently cannot be due to eclipses, as the times of fall and rise would in that case be nearly equal, since the eclipsing star would move off about as fast as it moved on.

The variation of both these stars is of the same problem. Both stars show variable velocity in the line of sight, and by study of this it has been found that each of them is revolving in a highly eccentric orbit about a dark body—or rather about the common center of gravity of itself and the dark body—in the same period as that of the light-variation. The minimum does not occur when the dark star is between us and the bright one, and so we have additional proof that it is not due to an eclipse. It is also clear that the orbit must be inclined to the line of sight so that the dark star passes to one side of the bright one instead of directly in front of it, as otherwise we should have an eclipse and a second minimum.

The accepted explanation of the variability of these stars is that it is due to tidal action. The attraction of the dark companion must produce enormous tides in the liquid—or, most probably, gaseous—mass of the central star. Owing to the eccentricity of its orbit (which is about the same in both cases under consideration), the least distance of the dark body is but one-third of its greatest, and, since the tide-raising force varies inversely as the cube of the distance, it is 27 times greater at one time than at the other.

As the two bodies approach one another, the increasing disturbance of the atmosphere of the luminous one increases its brightness, the effect reaching its maximum shortly after the passage of the nearest point, or periastron. With the decrease of the tidal force the bright star gradually cools down, rising again only when the return of its satellite stirs up once more its central fires.

#### THE PLANETS.

Mercury is in Gemini, and is evening star till the 12th, when he passes between us and the sun, and becomes morning star. He can only be seen in the last days of the month, just before sunrise.

Venus is evening star, and is gradually coming out from behind the sun into a more conspicuous position, remaining above the horizon more than an hour after sunset.

Mars is evening star, being well past the meridian at sunset. He is more than twice as far from us as he was in February and only about one-sixth as bright, and is still retreating and growing fainter as he moves eastward from Leo into Virgo.

Jupiter is just past opposition, and at his nearest for the year. He is by far the most brilliant object in the southern sky, and his disk and satellites are easily visible with a field-glass.

Saturn is in Sagittarius, close to Jupiter. He is in opposition on the 5th. His rings are seen at the greatest possible angle and form a splendid telescopic sight, in spite of his low altitude.

Uranus is in Scorpio, about 8 degrees northeast of Antares. Neptune is in Gemini, too near the sun to be visible.

Full moon occurs on the morning of the 1st, last quarter on that of the 8th, new moon on that of the 15th, first quarter on the night of the 22d, and full moon once more on that of the 30th. The moon is nearest us on the 11th, and farthest on the 23d.

She is in conjunction with Jupiter on the afternoon of the 1st, Saturn the next morning, Mercury on the 14th, Neptune on the 15th, Venus near moon on the 17th, Mars on the morning of the 21st, Uranus on the night of the 26th, and Jupiter and Saturn once more on the night of the 28th and morning of the 29th.

### DEATH OF T. C. CLARKE.

Mr. Thomas Curtis Clarke, one of the best-known civil engineers and bridge-builders, died in New York, June 15, in his seventy-fourth year. He was trained to be a civil engineer and early in life engaged in various kinds of railroad work, but finally made bridge engineering a specialty, and his name is identified with many of the most important bridges built in the United States. One of the first of his works in this line was the building of the C., B. & Q. bridge at Quincy, Ill. In the piers and foundations of this bridge, Mr. Clarke was among the first of American engineers to use concrete upon a large scale. Mr. Clarke was the senior member of the firm which afterward became the Phoenix Bridge Company. Among the famous works on which he was engaged was the erection of the Kinzua Viaduct. In 1884 Mr. Clarke became one of the members of the Union Bridge Company, which soon became the largest concern devoted to bridge-building in the world. While Mr. Clarke was connected with this company they built the famous Hawkesbury Bridge in Australia, which is one of the first cases where a bridge was built in a foreign country by an American concern. He also had special charge of the Poughkeepsie Bridge. It is stated that Mr. Clarke had been concerned in the building of over eighty miles of bridges and viaducts. He was well known as a writer upon professional subjects.

### SCIENCE NOTES.

The Baldwin-Ziegler polar expedition will start shortly for the north.

Mr. Morris K. Jesup has perfected an arrangement by which the American Museum of Natural History and the South Kensington Museum will exchange exhibits.

The Arnold Arboretum, in the suburbs of Boston, has carried on its highly interesting and important work on a very slender income. Steps are now being taken to raise $300,000 in addition to the present endowment.

The Massachusetts Institute of Technology has held examinations in London for the entrance of pupils to the Boston institution. The London Engineer says: "It would seem that American competition is not to be confined to commerce in the future."

Prof. Nicols Finsen, the inventor of the light cure for lupus, has been summoned to London by the Queen of England to superintend the administration of the apparatus which her Majesty presented to the London Hospital. The Belgian government also proposes to install the cure at Brussels, and Prof. Dubois has been dispatched to Copenhagen, to become acquainted with its application.

The invention of the mariner's compass by Flavio Gioja is to be celebrated this summer at Amalfi, Italy. Gioja came from Positano in the hills back of Amalfi. There have not been wanting those who contend that the invention, like most others, was gradual, and that the tendency of the magnetized needle to point north was known long before Gioja's time, it even having been familiar to the Chinese.

Prof. Henry Truman Henry Safford, an eminent mathematician and astronomer, died recently at Williamstown, Mass. He was born in 1836 and was known in his early youth as the "Vermont boy calculator." In 1866 he was appointed Director of the Astronomical Observatory at Chicago. From 1869 to 1871 he was engaged upon the great catalogue of stars then in course of preparation by the co-operation of European and American astronomers. This work was interrupted by the Chicago fire of 1871. He prepared a star catalogue which was published by the War Department. He did considerable work in relation to latitude and longitude.

John D. Rockefeller has given $200,000 to found "The Rockefeller Institution for Medical Research." The gift is not for an endowment fund, but for immediate expenditure. Mr. Rockefeller has for some time been consulting with eminent medical men as to the need of such an institution, and he has had the best of advice. Facilities for original investigation are to be provided, especially in such problems in medicine and hygiene as have a practical bearing on the prevention and treatment of disease. The first work of those connected with the institution will be that of co-operating with the Board of Health in studying its work and the problems confronting it, particularly that of milk supply. Work of a more ambitious nature will be begun in the fall under the guidance of experienced investigators.

In Europe it has been found rather difficult to introduce the circuit-system for the transmission of meteorological messages for a time after each observation. In the United States this is very easily accomplished, but in Europe, where the control of the wires is in the hands of different governments, the difficulty of introducing a similar method is almost unsurmountable. The system recommended by the Deutsche Seewarte is called the radial system, in which the observations pass through the central offices. Special observations have been made for nearly a year at eight A. M., mid-European time, at some thirty-five stations in various countries, including several in the British Isles, and forwarded to the Deutsche Seewarte, which enables the Hamburg office to issue reports as early as nine A. M., and the early publication of this information has been found to lead to such satisfactory results as to warrant a considerable extension of the plan in the near future.