

able that "America for the Americans" should have been the burden of the addresses; and it was natural, in view of the astonishing progress which has marked the closing years of the old and the opening year of the new century, that there should be an undertone of conviction, sometimes spoken and at all times suggested, that the center of wealth and civilization was finding its way by the inevitable operation of economic and ethnical laws from the Old to the New World.

HIGH-CLASS WORK AT OUR NAVY YARDS.

The successful withdrawal of the damaged gun of the "Kearsarge" and the substitution of a new gun in its place, as carried out at the navy yard, Brooklyn, is another evidence of the high state of efficiency to which this yard has been brought in the past few years—an efficiency, we are happy to say, which, as far as the personnel is concerned, whether in the office or the shops, can be matched at any of the other yards of the navy. From the illustrations and description of these repairs which are given elsewhere in this issue it can be understood that the problem presented was as unprecedented as the method of its solution was ingenious and skillful. We are informed by Naval Constructor Capps, who is now filling the position at the yard vacated by Rear-Admiral Bowles on the latter's recent appointment as Chief of the Bureau of Construction and Repair, that much of the credit for this work is due to the intelligence and skill of the workmen and the great interest which they showed in the successful carrying through of an admittedly difficult job. By the same authority we are assured that his experience of the work and methods at both private and government yards justifies him in saying that results at our naval yards are to-day not merely equal but superior to those secured at the civil establishments. It was not always thus; and the present satisfactory condition of things is to be attributed largely to the emancipation of our navy yards from the last vestige of political control.

THE "FACTOR OF SAFETY" IN "SHAMROCK."

BY OUR ENGLISH CORRESPONDENT.

In the designing of previous challengers for the "America" Cup, Mr. George L. Watson has always been held more or less in check by considerations of cost. On this occasion Sir Thomas Lipton gave him an absolutely free hand in the spending of money, and this is probably the reason why so much experimental work has been done in connection with "Shamrock II." The elaborate tank tests by which the shape of the hull was determined were only the beginning of the experimental work done in connection with the yacht. Sections of every tubular spar, and of every bit of wire used for rigging, were taken and tested to destruction before the weight of materials was fixed. In deciding upon these weights the margin left for safety was of the smallest, and the result brought disaster in the first three or four trials sailed.

The first time she was under canvas in anything of a breeze brought out an abnormal stretch in the running gear and rigging, and the strain of bobstay and jib halyards on the bowsprit end found a decided weakness in the butts in which the heel of the bowsprit is set. They started from the deck, and before she could be brought out again a collar had to be fitted taking in the bowsprit heel and bracing it to the stem-head. When these things were made good she was started again, and this time she caught a shrieking squall which put her to rather a severe test. Again it was demonstrated how small has been the margin allowed for safety; for though the squall was nothing worse than might be expected, even in summer weather, it left her lying helpless like a crippled seabird. It is said that trouble started as she drove before the wind with the breaking of one of the backstay blocks. The boom was square off and one backstay was, of course, slacked away. When the other stay broke the mast whipped like a fishing rod, and it looked for a time as if every spar was going overboard. The mast stood, but the gaff broke short off. The topsail yard was a hollow wooden spar made for "Valkyrie III." and would probably have stood well enough had the gaff held. The gaff was, however, built of steel plates only three-sixteenths of an inch thick, and the jerk of the mast was fatal to it. Discussing the accident afterward Sir Thomas Lipton stated, wisely enough, that if these things were too weak for racing strains, it was better that they should go then than in the actual contest. There is much good sense in this view; but the fact that so many accidents happened in weather which cannot be called abnormal proves how much Mr. Watson has sacrificed to the saving of weight. It has been a commonplace saying with British yachtsmen that the principal factor aiding the Americans in their successful defense of the cup has been the three thousand miles of ocean which divides Great Britain and Sandy Hook. One of the lessons of the trials has been to show that in the building of the latest of the challengers little has been conceded to the demands of the passage. Had the

yacht carried any handicap, in the shape of extra weight thrown in to strengthen her for the ocean passage, it is not likely that she would have developed so many weaknesses during the trials.

[The truth of our correspondent's estimate has received a dramatic endorsement in the most unfortunate wrecking of the "Shamrock" by a sudden squall in the Solent. He is right, moreover, in showing that it is not the dangers of the Atlantic passage that handicap the challenger so much as the delay—the loss of that invaluable time for tuning up, which enables a "Columbia," for instance, though beaten at the start of the season by a "Defender," to beat the older boat by ten minutes before the tuning-up process is over.

For the first time in the history of the races the English yachtsmen have had a good start and a trial boat; but this accident will rob them of all opportunity for tuning-up trials, unless Sir Thomas Lipton is given a sufficient extension of time to compensate him for the delay. The New York Yacht Club has an excellent opportunity to extend a sportsmanlike favor to a gentleman whose sportsmanlike ways have strongly commended him to the American public. There is a further reason for the extension in the fact that the end of August is a most unfavorable time for a contest, and the beginning of October will probably provide better cup-contest conditions than the date at first agreed upon.—ED.]

THE HEAVENS IN JUNE.

The most conspicuous object in the sky during the short June nights will be Jupiter, low in the southeast and south, with Saturn, much less bright, a short distance to the east. The two planets are now moving slowly to the west among the stars in their retrograde motion, and, in consequence of the more rapid motion of Jupiter, are slowly separating. By September the retrograde motion will have ceased, and the two planets will be moving eastward with gradually increasing speed. Jupiter, making the eastward circuit of the heavens in eleven years, will overtake Saturn, moving much more deliberately eastward, in a period of thirty years; and at the end of November will pass by, nearly a moon's diameter to the south.

That Jupiter is much brighter than Saturn, several times as bright, indeed, is evident. But to estimate with any approach to the truth the number of times as bright, without instruments of measurement to assist the vision, is something quite beyond human psychology. In fact, even the measures are not so accurate as might be desired, when the photometer is introduced to suppress a measured percentage of Jupiter's light, so as to have the image seen by transmitted portion, varied at will, to be adjusted equal to the undiminished image of Saturn.

The brightness of either planet varies considerably from time to time. The planet is sometimes a little farther from the sun than the average, and so is less strongly lighted by the central luminary, on whom he is entirely dependent for the light he sends out. He is somewhat nearer to the earth when both are on the same side of the sun, and so he looks a little bigger (in the telescope) and seems a little brighter than when they are on opposite sides of the sun. And in the case of Saturn the splendid ring may be edgewise toward the earth, when, on account of its excessive thinness, the light from it is substantially nil; or the ring may be turned up toward us at such an angle that its apparent short diameter is half its long diameter, in which case the ring gives fully as much light as the ball of the planet.

Assuming that the reflecting power of the surface of Saturn is equal to that of the surface of Jupiter, the theoretical ratio of their brightness is readily calculated. Taking the planets as now situated, the distance of Saturn is almost double that of Jupiter, so that, in accordance with the law of inverse squares, a unit of surface on Saturn would receive from the sun scarcely more than a fourth as much as a unit of surface of Jupiter; the distance of Saturn from the earth is a trifle over double that of Jupiter, so that if Saturn's actual radiation were equal to Jupiter's he would seem from the earth to be scarcely a fourth as bright. Of the sun's radiated light, then, Saturn renders to the earth one-sixteenth as good an account per unit of surface as Jupiter. As the diameter of Saturn is 70,000 miles, and that of Jupiter 86,500, the ratio of their surfaces is about as two to three, which would give for the light from the ball of Saturn about one-twenty-fourth, or 4 per cent, of the light of Jupiter. The light from Saturn's ring, which is now only beginning to recede from its widest open position, may be taken equal to that from the ball, so that the total light from Saturn should be, if the reflecting power of the surfaces of the two planets is equal, 8 per cent of the light from Jupiter. That the surface-reflecting power is the same in the two cases seems not to be quite true; photometric measures of the brilliancy of two planets, carefully taken, and compared with their theoretical brilliancy, indicate that the surface of Jupiter reflects about 60 per cent of

the light received, and the surface of Saturn about 70 per cent. Perhaps it would be safe, at the present time, to take the brightness of Jupiter to be ten times the brightness of Saturn.

After their opposition to the sun in July both will decline a little in brightness, Jupiter a little more than Saturn.

Aside from the ring of Saturn, which is absolutely unique, the two planets are much alike. They are much larger than any of the other planets of the solar system. They both have a very low density, Jupiter a little more, Saturn a little less, than water. Both are brighter at the center than at the edge, and both have belts as their chief surface markings. Both rotate in about ten hours. Their spectra are very similar, giving strong atmospheric indications. On Jupiter at least the movements of the numerous spots are incompatible with a solid surface such as the earth's, while presumably Saturn's surface is similarly mobile; indeed, some suspicion exists that possibly there may be nothing of a true solid about either planet, even at the center.

THE PLANETS.

Mercury will be visible the entire month, just after sunset, near to the horizon, a little north of west. This will be an unusually good opportunity to look at the innermost planet, which so few people have ever seen; in fact, in spite of the smallness of the area of the eclipse track of May, 1900, probably many more people saw Mercury, then close to the sun's corona, than have seen him the world over for the last ten years. Venus will be far enough away from the sun after the middle of the month to be comfortably seen; and at the end of the month will begin to be a good evening star, with Mercury a few degrees to the south. Mars will be seen in the west in the evening, having decreased in brightness so much as to be no longer conspicuous. Jupiter and Saturn will rise about dark and will be prominent objects the entire night, low in the southeast and south. Uranus will be visible to the unassisted eye as a very faint star about ten degrees east of the bright star Antares.

THE CONSTELLATIONS.

Bootes will be overhead in the early evening, with Arcturus the most conspicuous star. Virgo will be in the southwest, and Scorpio in the south, the long curving line of stars of the latter stretching down from Antares being readily traceable on nights when the haze will permit. Ursa Major, with the big dipper conspicuous, will be in the northwest, rather high up. Aquila will be coming up in the east, and Lyra and Cygnus in the northeast. This portion of the heavens, while not very brilliant, is still a great improvement on the very dull constellations of the spring months.

SCIENCE NOTES.

Dr. Franz Melde, professor of physics in the University of Marburg, died recently.

Dr. William Jay Youmans, for many years the editor of the Popular Science Monthly, died April 10. He established the monthly in 1875.

A new form of sealing wax has recently been devised. It differs from the ordinary stick wax in that it is inclosed in a glass tube, from which it may be poured by heating the cylinder.

The St. Louis World's Fair, which is to celebrate the centennial of the Louisiana Purchase, may be said to have made a beginning by the passage of an ordinance by the city of St. Louis authorizing the issue of \$5,000,000 in bonds. Congress may appropriate an equal sum at its next session.

The Peary Arctic Club has chartered for its work this summer the steamer "Erik," which was recently purchased from the Hudson Bay Company. The cruise of 1901 is the fourth of the series under the direction of the club to assist Lieutenant Peary. The "Erik" will sail from Sydney about the middle of July, and will return about two months later with full details of what has transpired in the two years since Peary has been heard from.

The eclipse expeditions report varying success in the observation of the eclipse on May 18. At Singkel, Sumatra, Prof. Todd reports that while the weather was good the sky was cloudy, and during the total eclipse of the sun no instruments could be operated except the polariscope and the X-ray apparatus. Six auxiliary stations were established on adjacent islands within 33 miles, and three of them showed a clear eclipse. No shadow bands were seen and the corona was invisible. President Pritchett, of the Massachusetts Institute of Technology, received a cable message from Prof. Burton, in charge of the Technology eclipse party, announcing that important results had been obtained. The weather was cloudy during a portion of the eclipse, but all four contacts were observed and a brilliant corona was shown at totality which lasted nearly six minutes. Photographs were obtained. The most interesting and novel work of the party consisted in the observations obtained photographically of the shadow bands.