

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico \$3.00
 One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) \$3.00 a year.
 Scientific American Supplement (Established 1876) 500
 Scientific American Building Edition (Established 1885) 250
 Scientific American Export Edition (Established 1873) 3.00

The combined subscription rates and rates to foreign countries will be furnished upon application.
 Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 28, 1899.

ANOTHER SUCCESSFUL DEFENSE OF THE "AMERICA" CUP,

For the tenth time in the history of the "America" Cup have those who build and those who sail our yachts proved that they are well able to guard the historic yachting trophy that was captured nigh upon fifty years ago, in English waters. When we consider how keen is the competition and how narrow is the margin of difference between the competing yachts of the present day, we must admit that in beating the "Shamrock" by 10 minutes and 14 seconds in a light breeze, and by 6 minutes and 34 seconds in a heavy wind, the American boat has, verily, "done herself proud."

Among the axiomatic truths which nobody, with even an elementary knowledge of yacht-sailing, attempts to deny, is the fact that a boat which is weak in her windward work can never be a successful winner of races. No amount of speed to leeward or on reaching can compensate for the heavy loss which is entailed by inability to lie up close to the wind in beating to the weather mark. This truth has been demonstrated times without number; it received a most emphatic indorsement in the very first completed "America" Cup contest of the present year, when the marked superiority of "Columbia" over "Shamrock" in windward work in a breeze of sufficient strength to test their real sailing qualities, placed the ultimate issue of the contest beyond all doubt.

The contest between these two fine yachts afforded unusual interest in the earlier stages of the struggle, because of the unexpected light-weather qualities developed by "Shamrock." In the drifting matches which had occurred at the time we last went to press the "Shamrock" had proved her ability to keep very close to "Columbia" in running and reaching, while it was the common opinion of those who watched the boats that in the very light airs which prevailed her work, when close-hauled, was superior to that of the home boat. It evidently needed the test of a fair to strong sailing breeze to bring out the superb qualities of the "Columbia." The first opportunity was given on Monday, October 16, when in a breeze that varied in force from 6 to 12 knots an hour the "Columbia" beat the challenger by 9 minutes and 50 seconds in a fifteen-mile leg to windward and by 24 seconds on the run home before the wind. The yachts had no sooner started on the first leg than it was evident to the veriest amateur that "Shamrock" was unable to lie as close to the wind as "Columbia," there being apparently from three-quarters of a point to a full point of difference between their courses. It was claimed that the difference was due to the English skipper's endeavoring to sail his boat with a "rap full," while "Columbia" was held closer with sheets more fully aboard. As a matter of fact, however, the second race over the windward and leeward course, sailed on Friday, October 20, proved that the fault lay in the boat and not in the skipper, for while "Shamrock" appeared to foot about as fast through the water as "Columbia," she was simply unable to approach her in ability to lie close to the wind.

The defect lies not in the model but in the rig of the English yacht. Her form appears to be about as easy to drive as that of the "Columbia;" for on two occasions in running fifteen miles to windward there has been but little difference between the two boats, and it is probable that had any reaching been included in the trials she would have shown about the same speed as "Columbia." The difference lies in the sail plan and the truth of the matter is that "Columbia" is rigged more in accordance with the latest theories and practice. Her mast is stepped further forward and a larger proportion of her sail area is in her mainsail. Five, in his endeavor to secure the fine reaching qualities which invariably characterize his yachts, placed more sail in the fore triangle than is customary in the sail plan of other designers. The failure of "Shamrock" in her windward work seemed to indicate that he has carried his ideas too far in this direction.

It will always be a matter of regret that the breaking of the "Shamrock's" topmast shroud, with the

consequent loss of her topmast, should have prevented the two boats from having a trial over a triangular course; as this would have given the "Shamrock" an opportunity to show what she could do on her fastest point of sailing. We do not think that she would have won, for she certainly could not have shown sufficient superiority in twenty miles of reaching to overcome the lead of five to seven minutes which "Columbia" would have established in the ten-mile leg to windward. The decision of the committee that the race should count as one of the series was made in accordance with a stipulation suggested by Sir Thomas Lipton, to the effect that, as the contest this year was largely one between constructors, a breakdown on either vessel should be counted as a win for her opponent.

The third race, because of the splendid wholesale breeze that held true throughout the course, was by far the most exciting of the series. The "Columbia" started about one minute behind the "Shamrock" but overhauled her just before reaching the stake. After the boats had settled down on their first leg to windward, and "Columbia" had commenced to eat into the wind in the old familiar way, the issue was never in doubt for a moment. Her gain to windward was exactly 5 minutes.

We cannot close the subject of the present cup races without some reference to the great popularity achieved by the gentleman who was responsible for the challenger of 1899. Under the extraordinary delays and discouragements which have marked the weather conditions of the past three weeks, and the keen disappointment which must naturally be his on seeing so fine a boat as "Shamrock" defeated, he has borne himself with all those characteristics which mark the true sportsman. Whenever the next challenge comes from the other side, we can imagine no one who would be more welcome to the American people as its sender than Sir Thomas Lipton.

AN ENGINEERING TRIUMPH.

Unless the engineers' plans miscarry, the early days of December next will see the waters of Lake Michigan finding an outlet to the sea by two separate and widely divergent routes; the one being by the natural outlet through the Great Lakes and the St. Lawrence River to the North Atlantic, and the other through an artificial channel connecting the lake by way of the Illinois River with the Mississippi and the waters of the Gulf.

The Chicago drainage canal, as this channel is called, will easily take rank as one of the monumental engineering works of the century. Not only will it form one of the greatest artificial canals in existence, comparing in importance with the ship canals of the world, but as a work of municipal sanitation it is easily the greatest work of its kind ever undertaken. For whatever importance it may assume in the future as a new route to the sea for the waterborne commerce of the lakes, the canal was originally planned as a radical method of solving the problem of sewage disposal for the city of Chicago. It was realized fully a decade and a half ago that the time was approaching when it would no longer be possible to discharge the sewage of this great city into the same source from which it drew its water supply. Vast as is the volume of Lake Michigan it was only a question of time before the polluted waters of the Chicago River would find their way into the intake tunnels through which the water supply of the city was drawn in. However far the intake might be extended into the lake, the polluted stream under the influence of local currents invariably followed, until the problem of some other method of disposal had to be faced.

The plan adopted was at once daring and original. It involved the cutting of a great canal twenty-two feet in depth, from 162 to 202 feet wide, and thirty-five miles in length, from Lake Michigan to the Illinois River, a tributary of the Mississippi, and turning the sewage of the city into the vast drainage ditch thus created. In this way the polluted waters would be kept constantly in motion until they were lost in the great volume of the Mississippi itself. By the time it is completed, the work will have involved the excavation of nearly forty million cubic yards of material, of which no less than twelve thousand yards will represent solid rock, the other twenty-eight thousand yards consisting chiefly of glacial drift. The excavation of the canal involved the diversion of the Des Plaines River and the provision of suitable works to control its waters and preserve the integrity of the canal in times of flood. As is invariably the case in works of this character, the actual cost has greatly exceeded the preliminary estimates, and by the time the work is fully completed it will have cost the city of Chicago fully thirty million dollars.

The approaching completion of the work, which will provide a waterway capable of accommodating large ships of 19 and 20 feet draught, has naturally suggested the possibility of a through water way to the Gulf of Mexico by way of the canal, and the Mississippi River. The canal is, of course, much deeper than the Illinois River or the upper reaches of the Mississippi, and to

secure even the 14-foot channel proposed would entail a heavy expenditure on the part of the government.

It is natural that the people of Chicago, having in view the enormous development of commerce by way of the lakes and the Welland Canal, should find the prospect of another waterway to the seaboard very alluring, and he would be a bold prophet who at this early stage should deny that it would be a profitable undertaking. The decadence of steamboat traffic on the Mississippi since the development of the great railroad systems is a discouraging feature; but it must be remembered that the opening of a 14-foot waterway from Chicago to New Orleans, would place the question of river traffic on a very different basis from that under which it has made such a losing fight against the railroads.

REAR-ADMIRAL HICHBORN ON THE NEEDS OF THE NAVY.

The annual report of the chief constructor of the navy, Rear-Admiral Highborn, is of special value as embodying in full the lessons which have been learned from the varied experience of the late Spanish war. Although many valuable data had been gathered at the time of the last report, it was written too soon after the events of the war to enable the voluminous reports furnished by naval officers to be received and fully digested. The present report says: "In response to special orders the bureau has been furnished with a large mass of criticism and comment as to matters under its cognizance. This criticism is the result of the experience under war conditions of seventy-five officers, and covers twenty-five vessels of various classes."

The chief constructor was an early advocate of sheathing as a means of enlarging the strategical and tactical qualities of warships, and the operations of the late contending fleets proved that the advantages of this device have not been over-estimated. The wisdom of Congress in agreeing to the provisions that our newest battleships and cruisers shall be sheathed and coppered is fully confirmed. Another obvious lesson of the war was the necessity for restricting severely the amount of combustible material on board ship, and as a result we learn that during the past year advantage has been taken of the visits of the older ships to the dockyards to improve them both in this respect, and also in the apparatus fitted for fire extinction. While the general attention which has been attracted to the question has resulted in an increase in the number of commercial non-combustible materials, nothing has so far been produced we are told which is more suitable for general purposes than fire-proofed wood.

We learn that the reports which have been turned in by our naval officers confirm the impressions previously arrived at as to the strength, stability, seaworthiness and maneuvering powers of our warships. As to matters of detail, the criticism in the reports naturally centered on such features as were most intimately connected with war service, and which were, under the conditions, severely and thoroughly tested. In this connection it is gratifying to learn with regard to that most important feature, the supply of ammunition to the batteries, that the ammunition hoists, etc., gave very general satisfaction.

The sanitary condition of our ships, as evidenced by the supreme test of the health reports, was found to be in the main satisfactory, although some defects in ventilation must be remedied, especially in the older vessels. The presence of steam pipes in the living quarters of officers and crew is universally condemned; and the favor with which the electrical installations already made have been received, encourages the board to replace steam with electricity as a motive power for the various auxiliaries, as fast as experience warrants. The work already done in this direction includes the installation of 320 electric motors in thirty-six vessels of various classes.

Now, just here we would suggest that although the desire to improve the sanitary condition of our warships is commendable, and the advantages of electricity over steam in cleanliness and in keeping down the temperature between decks are obvious, there is a danger lest in its admiration of the electric auxiliary the bureau should push the substitution too far. For we must remember, that as compared with steam power, electric power is obtained at the cost not merely of increased weight but of a certain amount of power that is lost in the double conversion; and while, considered as a matter of compromise, the weight and power are willingly sacrificed in the case of the manipulation of turrets and ammunition hoists, where perfect control is desirable, we think that for the operation of deck winches, anchor hoists and boat cranes, the steam winch is, perhaps, preferable. No complete substitution of electric for auxiliary steam power would be warranted unless the weights of larger duplicate central combined engines and electric generators, together with the several auxiliary motors, was about the same or slightly less than the aggregate weights of additional boilers and the separate steam engines now used.

Electric motors are especially economical where intermittent power is required at varying intervals, pro-

vided a constant electric potential available at any moment is maintained.

Other things being equal, it is a question still unsettled whether the weights of an electrical equipment will overbalance a steam auxiliary. It is feared in some quarters that it may, and thereby necessitate sacrifices in such important elements in our ships as speed, armament, and protection. It is supposed that the inefficiency of the proposed new cruisers of the "Denver" class may be due in some measure to the electric auxiliary idea having been pushed too far.

The importance of providing increased docking facilities is emphasized by the fact that not only will the number of battleships in commission be doubled in the near future, but the time is approaching when extensive repairs may be necessary upon the earlier ships. Now, while the completion of the new dry docks will relieve the immediate situation, the present programme does not affect the two most important dockyards, namely those at New York and Norfolk where, in each case, a new dock capable of receiving the largest vessels is urgently needed. The same difficulty is confronting the Navy Department with regard to our rapidly growing fleet of torpedo boats and destroyers, although in this case it is thought that the docking problem can best be met by the construction of marine railways. Torpedo boats, because of their light plating, require frequent inspection of the bottom to detect corrosion. At present it is necessary to dock these diminutive craft in the large dry docks—a manifest waste of time and money, especially when these docks are in urgent demand for the battleships and cruisers.

The report, after emphasizing the need for improved and extended repair facilities at naval stations, closes by calling attention to the need for an enlargement of the corps of naval constructors. It is stated that the amount of work done in the last two years is plainly out of proportion to the number of officers in the corps, and has only been accomplished by overwork on the part of individual officers. We are of the opinion that there is no recommendation in the whole report that demands more immediate attention than this. In spite of the rapid growth of our navy of late years, and especially in the last two years, the total number stands at the old limit of forty, which is all that are allowed by law. Anyone who, like ourselves, was witness of the enormous amount of work taken in hand and successfully put through during the past eighteen months at the Brooklyn navy yard by Constructor Bowles and his assistants, will be prepared for the statement that this important branch of the service is sadly overworked.

THE HEAVENS IN NOVEMBER.

BY GARRETT P. SERVISS.

The expected return of the main body of the November meteors dwarfs every other astronomical event this fall. The splendor of their display, in 1833, made so deep an impression that they have ever since occupied a place apart in the popular imagination as the most gorgeous and startling of all celestial pageants. The fact that three of their periods measure just the span of a century tends to add to their reputation as a spectacle. Although their returns are separated by a space of thirty-three years and a fraction yet they may be seen three times in the course of a man's life. One who saw them as a child, in 1833, might have regarded their fiery menace with the cooler judgment of a middle-aged man in 1866, and, this year, may behold again the scene that marked the start and the turning post of his life with ineffaceable memories of wonders in the heavens.

But, while everybody hopes for a brilliant spectacle on this occasion, there are reasons for anticipating a possible disappointment. In 1866 the display, although imposing, was by no means as wonderful as it had been in 1833. The fact that the meteors were almost as abundant in 1867 as in 1866 showed that they were being scattered along their path. Later investigations indicate that this scattering of the meteors has probably continued ever since. The planet Jupiter, the great perturber of the solar system, has had his hand upon them. They are apparently traveling in several shoals, or parallel streams, and it may be that when the earth crosses their line of march it will fail to pass through any very dense column of the wanderers.

Yet, at the worst, it is certain that there will be a meteoric "shower." There may be only a hundred, or a few hundred, visible in an hour, or there may be many thousands. One unfortunate circumstance will be the presence of a strong moonlight, which will suffice to conceal many small meteors and to rob the larger ones of much of their brilliance. The maximum of the display is generally expected soon after midnight on the morning of November 16, and at that time the moon will be within twenty-eight hours of the full phase. At 1 o'clock A. M., November 16, the moon will be in the constellation Aries, about two hours west of the meridian, while the radiant point of the meteors, in Leo, will be about two hours from its rising point in the northeast.

While the best attainable information points to the first hour of the morning of November 16 as the time

when the meteors will be most numerous, yet the data are so uncertain that all observers are advised to be on the watch forty-eight hours earlier. Begin say at midnight on the 13th, and watch until dawn. Resume watching on the following night, and so on until the morning of the 17th. Every watcher for the November meteors on this occasion can have the satisfaction of knowing that his, or her, vigil is being shared, all over the civilized world, by thousands of the brightest spirits, which now inhabit the earth. The solution of the mystery of the November meteors will stand, in the perspective of a thousand years, high among the achievements of man.

The watch for the meteors will inevitably call many unaccustomed eyes to the starry heavens, and luckily the constellations on view include several of the finest. Like the meteors, however, the stars will suffer from the effulgence of the moon. At midnight in the middle of November the eastern half of the firmament is especially beautiful. Nearly overhead glitter the Pleiades, a silvery swarm. A little eastward appears the V-shaped figure of the Hyades, containing the red Aldebaran, marking the eye of the great bull Taurus which the imagination of the constellation makers pictured in the act of charging down upon the giant hunter Orion. The latter appears below the Hyades, toward the southeast, the uplifted "lion's skin," marked by a curving stream of small stars, being interposed between the hunter and the bull. Two brilliant stars, the brighter, Betelgeuse, of an orange tint, being the farther east, mark Orion's broad shoulders. A sparkling group above indicates his head. His beautiful belt, symbolized by three fine stars in a straight row, next catches the eye, while below the belt a splendid lone star, Rigel, shines in the giant's upraised foot.

An imaginary line drawn through the stars of the belt, and continued some twenty degrees toward the left, will point out the brightest star in all the heavens, Sirius, or the Dog Star. Northward from Sirius, and somewhat farther east, shines the lone first-magnitude star, Procyon. Above Procyon, but toward the west, are the twin stars of Gemini, Castor and Pollux. Between Gemini and Taurus flows the Milky Way, which makes its appearance north of Sirius in the east, and, crossing the heavens, disappears when the Northern Cross is setting in the northwest. North of Taurus and in the edge of the Milky Way is the brilliant white star Capellor. West of this is a curved row of stars, in a bright part of the Milky Way, belonging to the constellation Perseus, and below Perseus, also immersed in the Milky Way, is the zigzag figure of Cassiopeia and her chair. Half way down the western sky is the great square of Pegasus, and extending from one corner of the square toward Perseus, is a row of second-magnitude stars belonging to Andromeda. The Great Dipper is low in the northeast, standing on its handle.

THE PLANETS.

The remarkable assemblage of planets in the constellation Libra, to which attention was called in October continues. At the beginning of November Mercury, Venus, Mars, and Jupiter are all in that constellation, while Uranus is about 10° and Saturn about 25° east of its borders. All of these planets are too near the sun for satisfactory observation. Mercury and Venus, however, are moving away from the sun, and on the 16th the former attains its greatest eastern elongation, but it is so far south that it will not be conspicuous as an evening star. Venus will be seen in the southwest after sunset at the end of the month. A notable series of planetary conjunctions begins on the morning of the 4th, when Mercury and Mars meet. On the evening of the 8th Mercury and Uranus are in conjunction. On the morning of the 13th Mars and Uranus are in conjunction, and at noon on the 14th Venus and Uranus. On the forenoon of the 16th there is a conjunction of Venus and Mars, and on the forenoon of the 26th a conjunction of Venus and Mercury. On the afternoon of the 27th Venus meets Saturn, and on the afternoon of the 30th Mercury and Mars are in conjunction for the second time during the month. As these various conjunctions occur while the planets concerned are crossing the astrologically condemned region of Scorpio the high priests of superstition may be expected to make the most of them.

THE MOON.

New moon occurs on the morning of the 3d, first quarter on the morning of the 10th, full moon on the morning of the 17th, and last quarter on the morning of the 25th. The moon is nearest the earth on the forenoon of the 12th, and farthest from the earth on the evening of the 24th.

DEATH OF ADMIRAL COLOMB.

Vice-Admiral Philip Howard Colomb died October 14 at his residence in Botley, Hampshire, England, in the sixty-ninth year of his age. Admiral Colomb was one of the greatest authorities on naval affairs, and especially on the evolution of war vessels. He invented and secured the introduction of many of the devices which are now regarded as indispensable in modern warships. His first important invention was a system of flash signals for the British army which was adopted in 1859. In 1867 a system of flash signals for the navy

was adopted and it is now used in every navy in the world. His system of interior lighting for warships was invented in 1873 and it is now universally used where the electric light cannot be obtained. He was the author of many professional and popular works.

A NEW ZEALAND VESUVIUS.

For many years visitors touring through New Zealand never thought of leaving that country without first making a pilgrimage to the terraces of the Hot Lake district, about 180 miles distant from Auckland. This wild and curious territory is described by Mr. G. R. Falconer in the last number of *The Windsor Magazine*.

The white terraces of Rotomahana rose up in a series of twenty platforms in the form of a gigantic stairway. Each terrace was perfectly horizontal and of dazzling whiteness. The top step was vertically 80 feet above the base and sat 300 feet back. From every platform bubbles copious clouds of steam. A stream of boiling water continually flowed from the geysers and as it fell slowly from tier to tier the silicates with which the water was heavily charged became deposited, on its exposure to the air in wonderful lace-work designs of infinite variety and of dazzling whiteness and purity were formed. Not far from the white terrace was another termed the "Pink Terrace" where, owing to some coloring substance in the silicious waters falling from the geysers, the deposits were of a delicate pink hue from which was derived the name "Pink Terrace."

Unfortunately New Zealand no longer possesses this unique spectacle for the terraces are no more. The various agencies of nature which originally built up such curious forms served in turn to destroy them. Mr. Falconer gives a graphic description of the event. He was residing at that time about 40 miles distant from Tarawera. In 1886, on June 10, the night was clear and calm. Heavy rumbling sounds like rolls of distant thunder filled the air but there was no very great alarm. The next day dawned dull and gloomy. About half-past seven o'clock the morning grew darker and light gray ash, very fine, began to fall. He says that although they surmised an eruption was taking place in the Hot Lake district, there were no definite tidings to that effect so that he could only wait to see what would happen. By the aid of a lantern he succeeded in groping his way to the telegraph office, and there he learned that a serious disturbance was taking place at Tarawera and Rotomahana. About eleven o'clock the darkness lifted. All round the ground was covered with a thin filmy pall of fine ash to the depth of half an inch and it was afterward found that the intense darkness was caused by a thick cloud of dust blown out by the volcano to a height so tremendous that it passed above Tauranga and dispersed over the country some miles away.

The manifestation was accompanied by intense cold, the thermometer registering 5 degrees of frost. This is explained by the fact that the columns of steam as they came hissing out of the craters, expanded as they ascended and absorbed their own heat which became latent so that the heat was abstracted from everything near. A day or two later the Government geologist arrived at Tauranga and preparations to inspect the seat of the disaster were pushed rapidly forward. On the fourth day after the eruption, the party arrived at Wairoa the Maori village. There was scarcely a vestige of the settlement to be seen, the whole village had been crushed beneath the volcanic lava and the charred and battered remains of the little village church and other buildings protruded above the surface of the deposit, which at first, measured 4 feet in thickness, but afterward settled down to half that depth. One young Englishman was killed as well as the Maoris who lived in the district and exacted tolls from visitors to the Hot Lakes. The scene was the wildest imaginable. The air rushed over the land with cyclonic fury, uprooting, tearing and breaking trees that had survived the hail of rocks leaving here and there a gnarled and jagged trunk denuded of branches and stripped of its bark.

The next day the party set off for Rotomahana. As they approached the Hot Lakes huge cracks extending hundreds of yards in length and about a foot in width were seen in all directions. The scene was one of the strange grandeur of absolute desolation. The upheaval of nature had blown the wonderful terraces to atoms; steam was rising in dense clouds from one end of the area to the other, a distance of about nine miles. Rotomahana Lake was a yawning caldron from which rose a majestic column of steam. The ground was completely stripped of vegetation and covered with lava from the mountain. The lava was reduced to the consistency of flour so that the explorers sank in it nearly to their knees. Thus in the space of time was North Island suddenly shorn of its most peculiar natural features. In six hours the whole aspect of the country was changed, and what was one of the most beautiful spots in the world was transformed into a barren country carpeted in lava and covered with debris. The geysers, however, still abound in profusion, and it is possible in time other terraces may be formed.