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) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 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, MARCH 30, 1901.

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 GANZ SYSTEM AND THE LONDON ELECTRIC RAILWAYS.

There is food for thought in the fact that the directors of the Metropolitan and District Underground Railways have decided to use the Ganz high-voltage, tri-phase system in the electric equipment which is to be carried out on these two important roads. The selection was made from a large number of competing bidders, among whom were included the representatives of the leading electrical firms in this country. It is stated that the choice of the directors was based upon the fact that the Ganz bid was $1,000,000 cheaper than the lowest American tender, and that the operating expenses were represented to be 30 per cent lower than those of the low-voltage, direct-current, system as used in this country. American practice is to generate high-tension alternating current for transmission, and transform it at sub-stations to low-tension direct current for use at the motors, the usual potential being about 500 volts. In the Ganz system, as used in the new Italian road, three-phase current of 20,000 volts potential is supplied to the line, and is transformed at sub-stations to 3,000 volts, at which high pressure it is used directly at the motors. The Hungarian engineers have succeeded in overcoming the difficulties of insulation which are attendant upon the use of such high pressure, and have apparently gained all the resulting economies of construction and operation.

It can justly be claimed that America is the birthplace and the home of successful electric traction. We have hitherto led the world both in the improvement and development of this system of transportation, and to many people it will come as something of a shock that a European firm should apparently have moved ahead of us in the improvement of the art. If the contract should be secured by the Budapest firm it will be but another illustration of the fact that, however supreme a nation may be in any particular industry, it can never afford to rest upon its laurels. It must be prepared to meet an ever-extending competition, as other nations begin to center their intelligence and skill upon the improvement of existing systems and plants.

CUP-YACHT DESIGNING.

Since the year 1893, when four yachts were built for the defense of the "America" Cup, the responsibility of designing a defender has rested upon the shoulders of one man, whose name is identified throughout the yachting world with the fastest craft that have ever hoisted canvas in an international cup race. Although the cup has proved on three memorable occasions to be perfectly safe when its defense was intrusted to Mr. Herreshoff, it is believed that its future security would be better assured if more than one designer were engaged at each contest in the production of an "America" Cup defender. The task of constructing the fragile hull of a 90-footer, and giving it the necessary strength to carry its enormous load of lead below, and above, its towering spread of canvas, requires both skill and experience. Experience and an accumulation of well proved data are especially valuable, for it is a well-known fact that yacht designing is not an exact science, not, at least, in the sense in which bridge construction may be said to be so. Originally the yacht-builder was a man of rule of-thumb methods altogether, and there are even to day many points, both in the modeling of the boat and in her sail plan, which are determined, not by scientific formula, but by the particular fads or prejudice of the individual designer. One man prefers bluffer bows and leaner quarters; another thinks that better results come from a straight, sharp entrance and rather full, broad quarters, as in the "Shamrock" of two years ago. In one sail plan we see the cloths running parallel with the leech, in another they are cross-cut; while the controversy as to whether sails should be as flat as the proverbial board, or whether they should have left in them something of that bagginess to which the English yachtsmen who succumbed half a century ago to the "America" largely attributed their defeat, is still a matter for conjecture. One yachting sharp believes in setting up his rigging perfectly taut; another will tell you, as the father of a noted yacht designer interested in the last cup contest did, that "Shamrock" lost the races because the rigging was not slacked up to the degree which insures getting the best results out of the sails!

All of which goes to prove that there may be more things in yachting philosophy than have yet been dreamed of, and the steady increase in speed which has taken place of late years gives reason to believe that we have by no means reached, in form of hull or in sail plan, the theoretically perfect racing craft. The more designers of cup defenders, then, the more ideas, the more proved and reliable data, the more development, and, most important of all, the less possibility that the successful defense of the cup will cease with the incapacitation or death of one individual.

For this reason we are glad to note that this year there are two yacht designers engaged in the task of defending the "America" Cup, and the more so as the yacht which is being built from Mr. Crowninshield's designs is of a type which will differ very widely in some respects from what might be called the typical Herreshoff model. Although no particulars have yet been given out, it is practically certain that the new Herreshoff boat will be an improved "Columbia," and will embody in herself the accumulated experience which has resulted from the construction and sailing of the "Vigilant" and "Defender" and "Columbia." It is also probable, in spite of certain sensational rumors to the contrary, that the new Watson boat which is building at the Denny's yard will be in all respects a standard Watson craft, the lineal descendant of the "Britannia," "Valkyrie," "Meteor" and last year's "Sybarita." There will be far more likeness between the Watson and Herreshoff boats than there will be between the Herreshoff and the Crowninshield craft; and, strange as it may seem, it is possible that from a yacht constructor's purely technical point of view, there will be greater interest evinced in a contest between the two American craft than there would be between the Herreshoff boat and the English challenger.

The "Independence," whose plans are fully described elsewhere, is an attempt to apply to the 90 foot yacht a form of hull which has been developed of late years in the keen competition between small craft of 15 and 20-foot waterline. In no branch of yachting has greater ingenuity or freer inventiveness been shown than by the designers of these little "raters." A wide variety of models, many of them positively grotesque, have been built and tested: boats of great beam and enormous overhang, flat-ended boats, boats with wing ballast, others with keel ballast, and others with none at all; while out of the competition there has been evolved what is known as the scow-form of yacht, which is, for its size, by far the fastest sail-driven craft with a single hull in the world. The "scow" has enormous overhangs, a flat floor and a hard bilge. Her beam is ridiculously wide; when she is heeled her model is such that her sailing-length is almost doubled, while the weather half of the boat, lifted often entirely out of the water, is depended upon to give the boat stability. The "Independence" is practically of a modified scow form, with the deep fin-keel and lead ballast of the typical 90-footer hung beneath it. When she heels to a breeze her sailing length will be increased far beyond that of any previous cup contestant, and unless there is any serious difficulty with the steering and control of the boat when there is any weight in the wind, the great spread of sail which she will be able to carry, coupled with her relatively small displacement, should render her an extremely fast yacht.

YELLOW FEVER.

Now that we have before us the full and authentic report of the proceedings of the Pan-American Medical Congress held in Havana 4th to 7th of February, the most important subject of which was the presentation and discussion of the report of the special yellow fever commission, we are able to form an unbiased opinion and to estimate to some degree the far-reaching influence which the findings of this commission will have upon the theories of the causation of disease and of contagion and infection, as well as upon vaccination and preventive inoculation.

Summarized, this report is as follows: Yellow fever cannot be communicated by contact with the patient or with the clothes or other articles worn by a patient before and during the course of the disease, although they may be impregnated with the excretion of the body. The disease is, therefore, not contagious. It can, however, be communicated by inoculation if a small quantity of blood from a yellow fever patient, taken during the first two days of the disease, is injected into a healthy person. If, however, the blood is taken later in the disease, or before the attack has set in, no result is obtained.

Yellow fever is communicated, however, by the bite of a particular kind of mosquito (the Culex fascinatus) that has previously bitten a yellow fever patient during the first two days of the attack. It takes twelve days for the specific poison to develop in the mosquito. Healthy persons bitten by such inoculated mosquitoes before the twelfth day after the contamination of the insect showed no symptoms of the disease, while those bitten after the twelfth day, without exception, were stricken with yellow fever after a lapse (period of incubation) of from forty-six hours to six days. Disinfection of houses and belongings of yellow fever patients, fumigation of letters from yellow fever districts, and quarantining of passengers from infected localities would therefore be unnecessary, provided the mosquito were destroyed.

The report concludes: "While the mode of propagation of yellow fever has now been definitely determined, the specific cause of this disease remains to be discovered." In the numerous reports of yellow fever epidemics in this country and abroad, and in the lengthy and erudite dissertations in medical literature, we find that the theory of contagion was by no means universally accepted by medical authorities, and was disputed as early as 1812 by Dr. B. Colomar in his report on the yellow fever epidemic in 1811 in Spain. We can therefore readily accept the demonstration of the commission of the non-contagiousness of yellow fever. There are, however, many peculiarities in the transmission of the disease recorded in medical literature, which cannot, as yet, be fully explained by accepting the statement that the mosquito is the only carrier of the disease virus. It is true we can explain why General Butler succeeded in stamping out yellow fever in New Orleans by establishing proper sewerage and rendering the city habitable and healthful, but unhealthful for the Culex fascinatus, and why the epidemics invariably cease when the average temperature of the air falls below 70 deg. F. For we know that the insect cannot live in clean places or a cool atmosphere.

Other malarial diseases have been stamped out in certain localities by planting eucalyptus trees, which by their rapid growth and greed for moisture drain swampy places, or by the artificial draining of swamps, thereby making it impossible for certain species of mosquitoes which are the carriers of the fever to exist in these localities. We cannot, however, as yet explain in what manner the virus is transported over great distances of land or sea, distances too great for the culex to traverse. We must look for an explanation in the results of experiments which will determine what is the specific virus and what is its origin. For it is very plain, almost self-evident, that it is not a bacillus or coccus. It must be ascertained whether or no the eggs and larvæ of the infected mosquito (for it is the female insect only which sucks the blood of animals) carry within them the specific poison in a latent form to become potent in the fully developed insect, and if so what are the most favorable conditions of climate, temperature and surroundings for the development and life of the insects. Finally we must learn what is the most practical and effective method of destroying the insects and their eggs and larvæ.

When these questions have been answered we will be able to stamp out yellow fever and a number of other epidemic and endemic diseases and make the so-called "foci" of such diseases as yellow fever in Havana and the West Indies, and cholera in India, salubrious instead of disseminating depots of scourges for the whole world.

NEW METHOD OF AERIAL TELEGRAPHY.

The ingenious system devised by M. Paul Jegon for use in aerial telegraphy has for its object the localizing of messages sent by a given transmitter, so that of a given number of receivers within its radius of action, each post will receive the message intended for it and no other; it is not intended to assure the secrecy of the message. Each of the receiving stations has two masts of unequal length, and each of the masts is provided with a separate coherer and battery. The two circuits have in each of them a coil wound upon an iron core side by side, but in opposite directions, so that when a current flows in one of them an induction effect is produced in a third coil wound upon the core, but when both circuits act the effect is neutralized and the third coil is not acted upon. The third coil is connected with a galvanometer to indicate the presence of the signals. The case of two receiving stations of this kind, 1 and 2, placed at different distances from a transmitting station A, may be considered, and it will be found that communication may be made with one or the other at will. The transmitting station has two masts of unequal length, and the longest of these gives waves which are

powerful enough to reach the station 2, and act upon its long mast, but not upon the shorter; thus A, by using the long mast, may communicate with B and deflect its galvanometer. As to the station 1 which is nearer A, the distance is so much shorter that the waves may act upon both the long and the short masts, and as the effect of the two circuits is neutralized the galvanometer will not be deflected. In this case it will be seen that A communicates with station 2 but not with 1. To produce the contrary effect the short mast of the transmitting station is used; its waves are not sufficiently powerful to act upon the distant station 2, nor even upon the shorter mast of station 1, but they act upon the long mast of 1, and the galvanometer is accordingly deflected. By a proper disposition this system may be applied to a number of receiving posts placed at different distances, and each receives its proper message.

BUILDERS' TRIAL OF THE "ILLINOIS."

The builders' trial of the U. S. battleship "Illinois" took place off Cape Henry Tuesday, March 12. The "Illinois" left the dock at the Newport News Shipbuilding and Dry Dock Company's yard at 7 o'clock A. M., proceeding down Hampton Roads to Old Point Comfort and Cape Henry, then to sea about 25 miles, where the trial for speed was made. The greatest speed, which was taken by log, was 16.2 knots, during which time the engines developed 11,920 I. H. P. at an average of 108.5 revolutions, and under a boiler pressure of 175 pounds. The vessel had been lying beside the dock for ten months, and her foul bottom accounts for the poor showing in speed. From the high horse power developed the indications are that, with a clean bottom, she will exceed the speed of her sister ships on the official trial. The "Illinois" is fitted with two sets of triple-expansion engines with cylinders 33½, 51 and 78 inches in diameter and 48 inches stroke. There are eight single-ended Scotch boilers 15 feet 8 inches diameter and 9 feet 11½ inches long, with 685 square feet of grate surface and 21,649 square feet of heating surface. Forced draught is furnished by eight blowers 60 inches diameter and 14 inches width of tip, each run by a 5 by 4 double engine. The propeller is 16 feet 9 inches diameter and set at 17 feet 3 inches pitch. The builders are well satisfied with the showing made and are rapidly preparing the vessel for the official trial.

THE PATENT OFFICE—RESIGNATION OF THE COMMISSIONER OF PATENTS

We are advised that the President has received the resignation of Charles H. Duell as Commissioner of Patents, who is about to return to active practice in this city, after having held the position of Commissioner very acceptably since February 5, 1898.

At the beginning of his administration he found the work in the Patent Office greatly in arrears, and at once set about devising means to bring it up to a more businesslike standard. His success in this direction is a matter of record and the present celerity with which applications receive attention, despite their increase in volume, is a satisfactory proof that his efforts have not been in vain. The promptitude with which applications can be acted upon is helpful to inventors from the fact that it tends to keep alive their ideas and stimulate further invention. It frequently happens that important industrial enterprises are dependent upon the prompt or tardy action of the Patent Office officials, hence it is to be hoped that the present efficiency will continue, and if possible be improved.

Mr. Duell also brought order out of chaos in reforming the distribution of printed copies of patents which are so largely used by attorneys and inventors by placing at the head of this division a competent, active business man.

The printed patent copies were formerly stored in various nooks, corners and hallways difficult to find, often in the wrong places, improperly or carelessly numbered, entailing an amount of worry and delay in their procurement that was extremely annoying to the attorney and inventor.

On account of the vast accumulation of printed copies and the storage space required only seventy-five copies of each patent are now printed, unless special orders are received in advance of the printing. By this change much less shelf space is needed and a saving of room is brought about.

The new head of this division, with the approval of the Commissioner, has had erected many new alcoves of shelving readily accessible in the upper galleries of the Patent Office, where every patent, arranged in consecutive numbers, can be quickly obtained or "pulled."

An accurate daily journal is also kept of the exhausted patent copies by means of which the condition of the whole supply is readily noted. There is a pressing need for more room in the Patent Office, especially for the safety of the records in the assignment division, where it is reported about one thousand deeds a day are received for record. These valuable records are exposed to the danger of fire, a condition that would not be tolerated in any well managed institution, and one which is a menace.

During Mr. Duell's term of office the new system of classification has been introduced, the intent of which is to grade patents into kinds or classes so that the state of the art can be readily determined. Owing, however, to the multiplicity of subjects and subdivisions and the differences of judgment among individual examiners there appears at the present time to be no special advantage in the work accomplished over the old régime. The new Commissioner will need to give the system careful study if any improvement is to be effected.

Mr. Frederick J. Allen, of Auburn, New York, has been appointed to succeed Mr. Charles H. Duell to the important position of Commissioner of Patents, and will soon assume his new duties. We trust the new Commissioner will not only maintain the present standard of work, but greatly increase its efficiency.

RUSSIAN ARMY AND MARINE.

The Russian empire, occupying as it does such a vast extent in Europe and Asia, needs for its security the greatest army now existing. The present recruiting laws permit of mobilizing, in case of war, twenty-two classes of seven hundred and fifty thousand soldiers each, or, allowing a considerable margin, at least thirteen millions. This immense army must not be considered, however, as an instructed and mobilizable corps; it may be admitted that about four million soldiers ready for the campaign could, if necessary, respond to the call of the Czar. The Emperor is the supreme chief of the army, and no parliamentary assembly has the right to question his acts. Usually, the Minister of War acts as intermediary between the Emperor and the troops, and in such capacity his authority is of the greatest. To the Ministry of War are attached the higher Council of War, the Supreme Court of Military Justice, and the Military Cabinet of the Emperor; the War Department is divided into a Chancellery and eight grand divisions: Etat Major general, intendance, artillery, engineering corps, health, military schools, Cossack troops and military justice. The military territory is divided into 12 grand departments, at the head of which are the officers bearing the title of commander-in-chief; these have the command of the troops stationed in the region, those belonging to the territory and those of the various establishments. In several of the regions, in Finland, at Wilna, Warsaw, Moscow, Kieff, in the Caucasus, in Turkestan, in Siberia, and the Amour district, the commanders-in-chief are invested with a higher political authority, and take the title of Governor-General. The distribution of the Russian troops by army corps is not uniformly established, as in some other countries of Europe. It may be admitted, however, that in European Russia 52 divisions of infantry, 52 groups of mounted artillery, 23 divisions of cavalry and 44 batteries of mounted artillery constitute 25 army corps, of which two are in the Caucasus region. Beyond the Ural, in Siberia, in Turkestan and the Amour region, and, at present, in Manchuria, the organization is variable, and depends upon circumstances.

The corps of Russian officers is recruited in a great part from the Lower Military Schools, of which there are seven for the infantry, those of Kazan, Odessa, St. Petersburg, Tchougouiev, Tiflis, Wilna and Irkoutsk; two for the cavalry, Elisabethgrad and Tver; two for the Cossacks, Novocherkask and Orenburg. The remainder of the officers come from the Body of Pages of the Emperor and the Military Schools. These latter schools are open, in principle, to young men of all classes of society, including the under-officers and private soldiers; they are located at St. Petersburg and Moscow. The preparatory instruction for these schools is obtained at twenty-four cadet schools and three preparatory schools. For the higher military instruction four Military Academies are established, the Nicolas Academy of the Etat Major, the Michel Artillery Academy, the Nicolas Engineering Academy, and the Academy of Military Law. The Russian army on a war footing is composed of five contingents of the active army, thirteen contingents of reserve and four of militia of the first class; all these troops have received the necessary instruction and have been grouped by the officers of the active army and the officers of reserve. The militia of the second class has received no military instruction. The Cossack troops, which form a unique feature of the Russian army, are recruited in a special manner, and are clothed, equipped and mounted at their own expense; the State furnishes only the arms and ammunition. The effectiveness of the Cossack troops on a war footing would exceed 250,000 cavalry.

As to the Russian Marine, it may be remarked at the outset, that Russia has but a small coast development, and it is easy to defend by means of coasting cruisers and line of torpedoes, without counting the ice, which forms during several months an impassable barrier around the Baltic ports. The entry of the Black Sea would be stopped by the fleet of modern battleships constructed on the docks of Nicolaieff and Sebastopol. For some years since, the efforts of Russia have been directed toward the extreme Orient, and the vessels which are being constructed are designed to reinforce the Pacific fleet, being thus upon the open sea; the ports of Vladivostock and Port Arthur are constantly developing, and new vessels are being constantly sent there.

The Emperor is the supreme chief of the Marine, but he delegates his powers to one of the members of the Royal Family, this being in the present case the Grand Duke Alexis. This Admiral-General, who presides over the Admiralty Council, has under his orders the Minister of the Marine. At the present time the Russian fleet has seven first-class battleships, with displacements from 8,500 to 11,000 tons; three coast-defense cruisers, of 4,000 tons; eight armored cruisers, of 6,000 to 12,700 tons; three protected cruisers of 3,000 to 5,000 tons. All these vessels are at least twenty years old; to them must be added those which form part of the Black Sea fleet, including seven battleships of 9,000 to 12,500 tons and one cruiser of 3,000 tons. Besides, a fleet of twenty destroyers, etc., and seventy-five torpedo boats is distributed between the northern and southern coasts and those of eastern Siberia. The personnel for these different vessels is made up of sailors coming from the recruitment, who remain seven years in service. These men are in general embarked upon the same vessels; they are sent to special naval schools where they complete their instruction. The under-officers come from the ranks and cannot become officers; they do not form a very compact body, and generally prefer to leave the service at the end of the seven years. The number of under-officers and marines is about 41,000. The officers must belong to the nobility or be the sons of officers of the Marine; they come from two sources, those who pass the Cadet School of the Marine and those who engage as volunteers and after eighteen months of embarkment pass a satisfactory examination. The Cadet School of St. Petersburg is established on land and has besides numerous vessels for practical exercises; the course lasts six years, after which the cadets become midshipmen. As to the officers of the Marine, these include 55 rear-admirals, 92 captains of the first class, 212 of the second class, 724 lieutenants, and 366 midshipmen. A number of special naval schools enable these to complete their instruction; some of these are of a theoretical nature, as the Nicolas Academy, devoted to astronomy, naval architecture, etc., and others practical, as the schools of marine artillery, diving, torpedoes, etc.

Russia has but one arsenal on the Baltic, that of Cronstadt. Another is being constructed at Libau, not far from the German frontier; it is called Port Alexander III., and the work has been going on since 1891. On the Black Sea are those of Nicolaieff and Sebastopol, the former of these is in the interior, on the Bug River; in the extreme Orient are Vladivostock and Port Arthur. In the Gulf of Finland are the secondary posts of Revel and Sveaborg. Besides these a certain number of state and private docks and establishments aid in the construction of the fleet; the principal of these are situated on the Neva, near St. Petersburg, and at Nicolaieff. As to the volunteer transport fleet of the Black Sea, its origin goes back to the Turco-Russian war of 1877. At this period, the government lacked transport boats, and some wealthy individuals associated together in order to purchase the necessary vessels in Germany; these, however, arrived too late to be of service on this occasion, but the institution of the volunteer fleet was kept up, and the vessels already bought were added to. At the present time they serve to transport the necessary troops and military supplies to Siberia; on the return voyage they bring back a load of freight, including tea. Besides 12 rapid transport vessels of 12,000 tons and a speed of 20 knots, this fleet possesses a number of slower vessels.

THE REMAINS OF AN OLD INDIAN VILLAGE.

Mr. J. A. Udden has recently printed the results of his investigations of the remains left by an ancient tribe of Indians of the Siouan stock who formerly inhabited a village in McPherson County, Kansas. A series of circular mounds were opened, each of them being about twenty feet in diameter, and none of them more than three feet in height. Fifteen such mounds constituted the village, and it is noteworthy that their distance apart was 125 feet or some multiple of this number. No human remains were discovered, but a quantity of domestic utensils, bones of animals, pottery, tools, arrow-heads, pipes, etc., were found. The most remarkable item was a piece of chain-armor, which is presumably of European armor, and which may have come from the expedition of Coronado, who passed through this region in 1542.