# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors. PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN.

A. E. BEACH.

## TERMS FOR THE SCIENTIFIC AMERICAN.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied ratis for every club of five subscribers at \$5.00 each; additional copies at ame proportionate rate. Postage prepaid.

Remit by postal or express money order. Address
MUNN & CO., 36 Broadway, corner of Franklin Street, New York.

#### The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country. (\*ombined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

registered letter. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

#### Scientific American Export Edition.

The Scientific American Export Edition.

The Scientific American Export Edition is a large of splendid periodical, issued onge a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1) Most of the plates and pages of the four preceding weekly issues of the Scientific American with its splendid engravings and valuable information; (2) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition. 8x.01 a year, seat prepaid to any part of the world. Single copies, Scients. For Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The Scientific American Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

# NEW YORK, SATURDAY, NOVEMBER 20, 1886.

#### (Illustrated articles are marked with an asteriak.)

Aqueuuci, N. I., gate nouse for,	
propose d*	326
Arms, small, manufacture of in	
Belgium	325
Bert Paul	321
Bert, Paul Boiler, safety. Abendroth & Root	322
Books and publications, new	331
Brake car Morrow's*	323
Brake, car, Morrow's*	323
Centerboard for vessels, McFall's	ĸäžĭ
Crater, afloat in a	3 10
Cycloid, the*	330 328
Earthquake, effect of the, on the	•
South Carolina Railway*	327
Eggs, age of, to tell	
Engine, petroleum, new Fish, pruning knife*	1225
Fish printing knife*	329
Fishes of the Malay Archipelago.	329
Fly catcher, Xever's*	824
Gun barrels, erosion of, by pow-	
der products	324
Gun, monster, a	
Hell Gate light to be stopped	
Inventions agricultural	331
Inventions, engineering	331
Inventions, index of	381
Inventions, miscellaneous	331
Inventor trials of	297
Inventor, triais of	9.8
Locomotives, automatic attach-	0.20
ment for	827
Medicine chest, with many con-	
veniences*	594
100000	0.02

Sugar, making, improvements in 325
Telephone, House, public rights
in .....

of. 320
Tunnel. railway, Rocky Mountain, proposed.
Umbrella support, Tosso's\*. 324
Vessole, apertures in hulls of, apparatus for Cosing\*. 328
Water for a greateity, bandling\* 328
Water tests, simple. 325
Water tests, simple. 325

# TABLE OF CONTENTS OF

# SCIENTIFIC AMERICAN SUPPLEMENT

No. 568.

# For the Week Ending November 20, 1886.

Price 10 cents. For sale by all newsdealers.

- PAGE I. CHEMISTRY.—Determination of Nitrogen in Coal and Coke.—A detailed account of Kjeldahla method as applied to these substances by C. Schmitz.—A titration process for determination of allowers in the form of annually account.
- II. ELECTRICITY.—Effect of Electricity on Fine Balances.—An interesting note of the effect upon the accuracy of balances of the electrification of the glass of their cases.—A previously unsuspend source of error.

  The Langhaus Battery.—A battery dependent on the action of a melted oxide or sulphide, the electrodes or plates being formed of carbon and metal.—A non-polarizing battery that only generates electricity on the application of heat.—3 illustrations.
- III. ENGINEERING.—Voussoir Calculation and Measurement.—By C. POWELL KARR. C.E., Consulting Architect, New York.—An elaborate article, treating of the methods of determining the factors of stone arches.—Empirical formulæ, with examples of actual bridges.—Full illustrations of graphic methods of laying out work.—Summary of methods and necessity for exactness of the work of calculation.—14 illustrations.
- IV. MINING AND METALLURGY,—Massick & Crookes' Hot Blast Fire Brick Stove.—A recent hot blast apparatus as erected at the Ashkam-in-Furness Iron Works.—Simplicity of its construction, permitting the use of ordinary fire brick.—Thorough absorption of the fiest of the waste gases.—Number of these stoves now working. Illustrations.
  The "Morgan" Miner's Safety Lamp.—An improved lamp of comparatively high illuminating power.—The recipient of a gold medal at the international inventions Exhibition.—The question of its efficiency and its claims to success.—2 illustrations.
- V. NAVAL ENGINEERING.—Launch of the French Ironclad Le Hoche—Detailed account of this launch; the question of support; friction on the ways; the absence of lateral inclination; success of the operation under the supervision of M. Huin, the designer.

  Triple Expansion Marine Engines.—A paper read by Mr. Robert Wyller, of Hartlepool, at the Leeds meeting of the Institution of Mechanical Engineers.—Full discussion of the subject, including among other heads the consideration of steam velocities, piston valves, sequence and number of cranks, artificial draught, and practical results attained on steamers. 9063
- VI. ORDNANCE.—Recent Improvements in the Manufacture of Rifle Barrels.—Abstract of a paper read at the last meeting of the British Association by Mr. ARTHUE GREENWOOD, M.I.C. E.—System of manufacture adopted at the Enfield factory; simultaneous drilling of three barrels from both ends; form of the drill bits; speed of rotation of the barrels; otherdetails of the process......
- VII. PHYSICS.—A Limit to the Height of the Atmosphere.—By HENRY A. MOTT. Ph.D., LL.D.—A 1/2/12 discussion of this question; the limit of height of the atmosphere determined by the action of centrifugal force upon its outer layers; full mathemati
  - action of centringal force upon its outer myers; in mathematical experiments in Polarized Light.—By George M. Hoppins.

    Simple Experiments in Polarized Light.—By George M. Hoppins.

    KINS.—An exhaustive treatment of the experimental study of this subject; observation of the effects of polarization with apparatus of the simplest as well as of the more complex that; home experimentation, and new objects for illustration of its laws; the most abstrace branch of the physics of light simplified; illustrations of polar zed crystal sections.—26 illustrations.

### THE GOVERNMENT SUIT FOR THE CANCELLATION OF ing an outside resistance of 20,900 pounds to the square THE BELL TELEPHONE PATENTS.

A suit for the cancellation of the Bell telephone patents was brought by the United States before an Ohio circuit court, in the city of Columbus. Much was hoped for from this action, but it has received one defeat court over a company not in its district was raised. It was decided that the Bell Company, being a Massachusetts corporation, was outside of the jurisdiction of an Olio court. Although a stockholder in the Ohio local companies, this was held not to be sufficient connection to establish a partnership. The opinion was a long one, covering 52 pages of type writing. The decision was given without prejudice, leaving it open for the plaintiffs to bring suit else where. The government can bring a motion in the Supreme Court for a mandamus compeding the hearing of the case by the Ohio tribunal.

The objections to bringing the case in Massachusetts were that, it being the home of the company, a bias favorable to its interests was to be feared. This decision, unless overruled by the higher court, virtually restricts the place of proceeding to the Massachusetts circuits. It is in another sense an unfortunate decision. It virtually tends to establish the fact that a monopoly, as stockholder, can perpetrate injustice in outside States as a stockholder in local companies, while it is protected in its own State by association and business in-

On January 24 the united telephone suits come before the U.S. Supreme Court on appeal. Burdened by concessions and incomplete as records of the full facts, a great deal is not to be hoped for from these cases. If, as the final outcome, the patent can only have its claims restricted to conform in some sense to the specification, some good will then have been done. At present the patent is held to cover all and every mode of transmitting speech electrically.

#### THE STATUE OF LIBERTY. NEW YORK.

Now that Liberty has been dedicated to her task of enlightening the world, there are some timorous minds who fear that something will happen to overthrow her. Where such a mass towers aloft in an exposed position, there are, of course, dangers; but investigation shows that all that human forethought could do probably was done to insure her safety and permanency.

There are five dangers to be feared, namely, earthquake, wind, lightning, galvanic action, and man. If we should have an earthquake of such force as to bring down the goddess, the ruin of New York would be so universal and complete that little thought would be wasted on her disappearance from her pedestal.

Man may some day pull down the statue, just as he has built it up—as the Communists overthrew the Colonne Vendome in Paris. Or a hostile fleet may take it for a target-as the Turks bombarded the Acropolis, in sheer wantonness. But such a fate could not be averted by any mechanical device in connection with the statue's "setting up." It would hardly be practicable, desirable, or artistic to inclose Liberty in shell-proof armor.

The statue's power to withstand the shocks of the wind may be considered as satisfactorily provided for. There are four upright iron posts, which support the whole framework inside. According to the plan designed by Mr. C. C. Schneider, civil engineer, these posts are bolted to six steel girders set upon the pedestal, having four similar girders let into the masonry at right angles to and below them.

Mr. Schneider found the greatest amount of surface exposed to the wind to be 3,475 sq. ft., and the central point of the wind's pressure to be 62 ft. above the base. Then, estimating the greatest wind pressure to be looked for in this latitude at 100 pounds to the square foot-a pressure that would be reached only when the wind was blowing at the rate of 140 miles an hour—the pressure of the wind at the foot would be nour—the pressure of the while with the state of the centers arrangement of the light when writing."

3,475  $\times$  100  $\times$  62 = 21,545,000 foot pounds. The centers arrangement of the light when writing." of the main posts rest upon the girders at a distance, or one side, of 1738 ft. from the centers of the bearings of the girders in the masonry, and, on the other side, at a distance of 13.78 ft.; consequently, the utmost possible wind strain on the points of support of the 21,545,000

= 1,239,600 on one side, and statue would be -17.38 21.545:000

- = 1,563,100 on the other side. 13.78

9064

The weight of the statue was given to Mr. Schneider as 160,000 pounds by one authority, and as 400,000 pelled to go back to white paper. pounds by another. The greater weight was taken in calculating the bending moment on the girders, while the lighter weight was used in calculating the wind strains, thus producing in each case the greatest strain to be provided against. It was then found that the of a case, so say the authorities, where the use of white

2083 was 2,083, or for each upper girder  $\frac{2000}{2}$  = 694. Assum-

inch for the girders, which were made of % in, steel, the moment of resistance of each one was found to be 737, or 43 more than required. The steel, n oreover, was tested for a breaking pressure of 80,000 pounds to the square inch instead of the 20,000 allowed in the already. The question of jurisdiction by a circuit calculation, so that the safety of the girders may be regarded as assured. But there are also backing plates and rods attached to the main posts and girders, greatly increasing the strength, and there is little doubt that before the statue could be overturned by the wind the pressure on its plates would be sufficient to tear them apart.

Against lightning, provision has been made by soldering four % in. copper rods to the inside of the statue against the external copper plates to a height of 15 ft. is just where it started from, with one exception. It above the pedestal. These rods pass through the pedestal, each inside of a 4 in. iron pipe tamped with coke dust, extending 5 ft. below low tide level in the earth. In the lower four feet of these pipes the copper rods are closely coiled like springs, thus giving a greater mass of metal in the wet ground connection. While there are some who insist that the mass of metal in the ground should equal the amount exposed to the lightning, it is probable that in this case the protection is sufficient. The statue itself is the best kind of a conductor as far as her pedestal; hence no outside rods are needed, and the copper rods extending into the ground will doubtless carry off any frashes that Liberty may attract. In any event, no damage would be done to the statue by a stroke of lightning, but only to the pedestal to the extent that the rods were unable to carry off the current.

Against galvanic action, an ingenious insulation of the copper from the iron framework has been employed, the insulating material used being asbestos cloth soaked in shellac; and the device has been managed so cunningly that in no place do the two metals come in contact with each other. It was at first feared that the durability of the statue would be threatened by the great expansion and contraction it would be subjected to under different temperatures, thereby wearing out the copper rivets, or even straining the frame. Experience so far has shown that the mottled or corrugated surface, due to the hammering the copper had received, has prevented much of the expansion that the direct rays of the sun would otherwise have caused. No two contiguous parts received the same amount of heat, and the expansion in midsummer was found to be much less than had been feared. Whether expansion and contraction will eventually produce a serious injury of any kind cannot now be decided; but the indications are not at all alarming.

# EFFECT OF THE USE OF WHITE PAPER UPON THE EYES.

Many believe the eyesight is impaired by the use of white instead of colored, or at least tinted, paper, and at times the subject comes up for discussion. So far as we have seen, no positive evidence has yet been secured to prove the injurious effect of white paper on the eyes, and some recent inquiries lead us to doubt if such evidence is to be had.

A company engaged in the sale of tinted paper recently urged us to say a word against the use of white paper for "billing, letterheads, records," etc., for that it does more to keep the oculist and optician busy than any other cause. Further along they say: "There is no doubt that, in a few years, tinted paper will be used for purpose above named [billing, letterheads, records, etc.], and the white paper now used will be an exception to the rule. In the interests of the clerks and bookkeepers, we appeal to you," etc.

Dr. St. John Roosa, one of the best authorities on the eye hereabout, said, when his attention was called to this: "I have never yet noticed any special ill effects upon the eye from the use of white paper. I have treated many bookkeepers and others who work with the pen, and do not remember to have heard any complaints against white paper, nor any commendations for tinted paper. My investigations show me that a principal injury to the eye comes from improper

He says he does not believe that people who use tinted paper for writing are freer from eye troubles than those who use white. As for himself, he has used both, first one and then the other, hoping to be able to note the different effects upon the eyes. None, however, were observed. Dr. Roosa might have gone a step farther, and said that instances could be cited where those accustomed to white paper having suddenly changed, and adopted that with a decided tint, found a mal-influence exerted on the eye, and were com-

It is well known that using the eyes too much or in bad lights will serve to hasten the development of myopia, presbyopia, strabismus, and dantonism where there is hereditary inclination; but there is no record greatest moment of resistance required in the supports paper hastened or the use of tinted paper retarded such development. It is not likely, therefore, that tinted paper will replace white in the business transactions of the future.