Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

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 news dealers throughout the country.

Combined 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, or registered letter Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once 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, $5.00 a year, sent prepaid to any part of th world. Single copies 50 cents. ☞ Manufacturers and others who desir to secure foreign trade may have large, and handsomely displayed an nouncements 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., 37 Park Row, New York.

NEW YORK, SATURDAY, AUGUST 14, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions 106
American giants, ancient 106
American industries* 100
Astronomical obs. at high elev. .. 100
Boat, folding, new* 98
Boiler, water required for (17) ... 107
Borax, analysis of (15) 107
Cargo, large, a 96
Car starter, improved* 99
Catamaran, steam, trial of 96
Catskills, geological history of ... 106
Chemical manufactures in Phila. 105
Cities, leading, our 100
Clothes-line pulley, novel* 98
Coal, American, formation of* .. 104
Cross tie, improved* 101
Cyprus reed stems, new use for .. 104
Decisions, patent 106
Diseases, virulent, prevention of 97
Earthquakes and volcanic erups. 97
Electricity affected by a magnet. 106
Electric light, Edison's, at sea ... 96
Engineering inventions 98
Engines, small (18) 107
Fish, air bladder in 104
Folding boat, new* 98
Giants, American, ancient 106
Glass, expansion of 105
Glycerine in gastric troubles 101
Ideas, evolution of 97
Identification, well marked for .. 98
Industries, American* 100
Inventions, agricultural 106
Inventions, engineering 98
Inventions, new 102
Iron capacity of United States .. 105
Lady patentee, a, pleads her case. 96
Livadia, the* 102
Locomotive, fast, for England .. 101
Mechanical inventions 101
Mercury, surface tension of 102
Milling, American 101
Motions, small, amplifying 104
Nickel, acetate of (2) 107
Oil tanks, protection of 101
Outriggers (19) 107
Patent decisions 106
Pencil drawings, to preserve (6) .. 107
Photo printing solutions (1) 107
Photos, transfer to porcelain (3) .. 107
Plant lice, to destroy (4) 107
Printing exhibits 105
Pulley, clothes line, novel* 98
Railway progress 96
Railways in Texas, progress of .. 105
Rain falls, precipitating 106
Salts of sodium, extraction of* .. 102
Seeds, duration of vitality of 103
Spiral energy 106
Steel, manufacture of* 95, 100
Stoves, improvement in* 99
Sturgeon, the* 103
Testing station, Berlin 98
Tobacco, California, native 99
Turtles, eighty square miles of .. 106
Waterproofing cloth (3) 107
Water supply, New York 101
Water works, American 105

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 241.

For the Week ending August 14, 1880.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Fishing Boats at the Berlin International Exhibition. 9 figures. Drontheim fishing boat.—English fishing boat.—Dutch fishing cutter.—Norwegian pilot boat.—German herring boat.—Tilting net boat.—Ocean fishing boat.—Shadow canoe.—Indian fishing boats 3834
The Royal Albert Dock. Full page figure. Map and sections 3838
American Coast and River Navigation 3839
Ornamental Design of a Gate. By M. TEGG, metal-worker, Berlin 3839

II. TECHNOLOGY AND CHEMISTRY.—Tessie du Motay's New Process and Apparatus for Hydrogen Gas. By CYPRIEN MARIE TESSIE DU MOTAY. 9 figures 3831
Linseed Oil and Electrified Oxygen 3833
Detection of Mercury 3833
Determination of Glycerine in Wines. By M. RANAUD 3833
Detection of Minute Quantities of Mercury. 1 figure. Apparatus for detecting mercury 3833
Metallic Varnish 3833
Artificial Wines 833

III.—ELECTRICITY, MAGNETISM, ETC.—Electrical Heat and Power 3837
Progress of American Telegraphic Engineering 3837
Deprez's New Galvanometer. 1 figure 3837
Velocity of Projectiles in Guns 3837
Measurement of High Pressures 3837
An Electric Vacuum Shunt 3837

IV. ETHNOLOGY AND SOCIOLOGY.—The Chinese in California.—Chinese immigration.—The mistake of the Kearneyites.—A Paradox in labor.—A chance for working girls.—The Chinese as servants.—Chinese enterprise.—Neglected labor.—The Chinese in the country.—John's taxes and treatment.—The sentiment in California 3833
The Discomforts of Summer Travel. Railway evils and opportunities for inventions and improvements 3836
Man on the American Continent. Antiquity of man in America. 3836

V. MINING AND MINERALOGY.—The Anthracite Coal Fields of Pennsylvania and their Exhaustion. A statistical and critical review of the geology and industrial development and future of our anthracite coal fields. By P. W. SHEAFER, M.E., of Pottsville, Pa 3840
Discoveries of Minerals in Western North Carolina. By JOHN T. HUMPHREYS 3841
New Use of Nickel 3841

VI. NATURAL HISTORY, ETC.—New Observations on the Habits of Ants 3842
The Archæopteryx. 1 illustration.—The reptile bird discovered in the slate layers of Solenhofer, Bavaria 3843
The Truncated Armadillo. 1 figure.—The truncated armadillo and its burrow 3844
Newly Discovered Nervous Energy 3844

VII. ASTRONOMY AND METEOROLOGY.—The Mechanical Action of Lightning 844
The Zodiacal Light. 1 figure. The zodiacal light at winter, vernal, and summer solstice 3845

VIII. ARCHÆOLOGY.—A Viking's Ship 841
Relics of an Ancient Wreck 3842
Excavations at the Southeast End of the Forum, Rome. 1 large illustration 3842

IX. MISCELLANEOUS.—Theory in Regard to Earthquakes 3833
The Coffee Product of the World 3836
Franklin's Place in Science 3845
The National Medical Library 3845
Ensilage. By O. B. POTTER. Conditions of success.—The preserving pits.—Filling the pits.—Mixing fodder in the pits 3846

RAILWAY PROGRESS AND REQUIREMENTS.

The enormous growth of our railway carrying business, which exacts an amount of work always in increasing proportion to the facilities for its performance, gives great prominence to all questions connected with car construction, improvements in locomotives, and economy in every detail of operating. At the late Convention of the Master Car Builders' Association at Detroit, as at the previous meeting of the Master Mechanics' Association at Cleveland, many subjects of this character were discussed at considerable length by men who not only have a practical acquaintance therewith, but whose interest leads them to make careful investigation and comparison of results obtained in the actual working of the different roads of the country. It is, perhaps, hardly the province of such associations to decide absolutely what shall be done in regard to the general adoption or discarding of certain forms of construction, or the materials to be used, nor is it likely that they could arbitrarily dictate to their employers, the railway companies, as to such points, and for this reason the results of much of their work appear on the surface to be quite inconclusive. There can be no doubt, however, that great practical benefit has resulted from their discussions and comparisons of experiments made. Of the Master Car Builders' Association, the late meeting constituted the 14th Annual Convention, while the Master Mechanics' Association this year held its 13th Annual Convention.

Mr. Leander Garey, of the New York Central and Hudson River Railroad, and President of the Car Builders' Association, places the increase in freight tonnage since 1870 at more than 100 per cent, and says that, although there are times during each year when it is difficult to find storage room for idle cars, it is impossible, in the busy seasons, to furnish the number required. During such periods the cars are loaded much beyond what they were intended to carry, and so it has frequently occurred that cars meant to carry only 10 tons have been made to take 12 to 15 tons. The increased freight offerings are expected within a few years to call for even double the present capacity, and President Garey thinks it is evident, from past experience, that in a short time the maximum load for 8-wheel freight cars will be at least 20 tons, while 4-wheel cars will be loaded with from 10 to 12 tons each, making the present ordinary freight car a thing of the past. Already the sizes of car axles have been increased by many of the builders, and this has enabled the railroads to increase the allowable tonnage on cars so built, but there are many other details in regard to which builders are invited to anticipate the future wants of the roads, rather than wait till they are forced to make necessary changes.

The general substitution of iron for wood and steel for iron in car construction, with such arrangement and proportioning of the parts as will secure the greatest strength with the least possible weight, is one of the directions in which particular improvement is looked for. In Europe it is claimed that iron has been proved to be better, cheaper, and lighter than wood for this purpose, and many patents have been issued here covering forms of car construction in iron and steel, but thus far such cars have not been largely used. The tendency is to make the iron car bed much heavier than necessary, and, with sheet iron sides, there is a great deal of trouble from rusting. The large advance in the price of iron and steel last year is said to have afforded the principal reason why no greater progress has been made lately in their substitution for wood in building cars.

The question as to what is the best style of brake for freight trains has engaged the earnest attention of the car builders for some time past. There are many patented devices in this line, but no one of them has yet received general approval as being just what is wanted in all particulars. Such a brake must, say the committee of the Car Builders' Association, be automatic and always reliable, and be applicable and operative on any car equipped with it, without regard to its location or the presence of other cars not so equipped in the same train. The perfecting of such special brake has only been sought within the past three or four years, but great progress has already been made toward the attainment of the objects sought.

In regard to cast iron and steel-tired wheels, wrought iron wheels with steel tires, and paper wheels, accurate results of trials on several leading railroads were given by different members at the meeting of the Car Builders' Association, but hardly enough data have yet been collected to make it apparent which kind of wheel, considering cost and amount of work done, would be best for general use. As to the size of wheels to be used, the general opinion seemed to be in favor of 42 inches, such wheels now being adopted to a considerable extent in the place of the old 33 inch wheels. On a level track and good roadbed it was said that 4 to 5 per cent of power was saved by the use of the larger wheels, though this was about all lost on up grades.

The rules under which the different companies exchange cars provide that where wheels have flat spots of 2½ inches or over the cars need not be accepted. These flat spots generally come from the wheels sliding on the rails, when they are held firmly by the brakes. It is not the intention to have the brakes hold the wheels fast, but only to check their motion, and let them slip under the hold of the brake, as this stops the motion of the train quicker, but with the varying weight resting upon different wheels this is so imperfectly attained that many flat spots are made on the wheels. When these spots exceed 2½ inches the wheels must be taken out and replaced at the expense of the company to whom the car belongs. The necessity for such and other repairs, which have constantly to be made, render it very desirable for the car builders, as far as possible, to follow a uniform plan of construction.

The fact that various lengths of gauges are employed for setting wheels for the same gauge of track presents a serious problem in the working of trunk lines, over which the cars of many different companies are run. Some of the roads have made the gauge of their tracks 4 feet 8¾ inches, instead of 4 feet 8½ inches, in order to better accommodate the different gauges at which the wheels of various companies are set, the difference in the lengths of gauges at which wheels are set varying something like one inch. On crooked roads there must, of course, be more lateral play, and this is generally found on the roads in New England. The result of a want of harmony among the companies on this question is that while, in some cases, cars will get between the tracks, in other instances the wheels fit so tightly between the rails that a good deal of power is lost in running trains. It would seem that, in a matter of such great importance, and yet involving only the most elementary principles of mechanics, it ought not to be difficult to secure substantial harmony between the railways of the country.

At the Railway Master Mechanics' Convention the questions discussed embraced the desirability of different forms of locomotive boilers; the best manner of annealing steel sheets after flanging; button boiler riveting, and the preven tion of smoke in locomotives. Valuable information touching the latter point was furnished by the master mechanics of several leading railways. The first and most important element in the prevention of smoke was conceded to be in having the locomotive boilers of the largest possible capacity consistent with a proper and safe weight upon the rails; the condition coming next to this in importance was more care in firing, so that the fuel should be varied in proportion to the amount of steam required with different loads, or in going up and down grades. The committee reporting on this subject ventured the opinion that the railroad companies might better have spent money in educating men how to properly fire locomotive engines then in most of the experiments they have made with "water tables, fire-brick arches, peculiar shaped furnaces, brick walls, and mid-feathers," etc.

All of these questions, with many more of the same nature, discussed at these assemblages of men practically acquainted with the subjects, are of leading importance to inventors, engineers, and mechanics everywhere. But they have also a much broader interest, in that the general public feel directly the beneficial effects of everything done to promote the efficiency of our railway service.

Freight on our railroads is now being carried at a cost of little more than one-half of what it was in 1873—the difference between now and then on thirteen trunk lines showing a reduction of 42·31 per cent. This freight, in 1879, was carried over nearly 2,000 miles more railway, thus largely increasing the cost, had it not been for the greatly lessened expense in operating the roads. A portion of this reduction has undoubtedly been effected by improved management, but how much of it is also due to the progress made by our mechanics and inventors? And to whom else are we to look for the further improvements sought? The field is a wide one, and practical men are constantly suggesting the direction in which it is most desirable for effective work to be done, the subjects here presented constituting only a few of those which hold a leading position.

Edison's Electric Light at Sea.

In the description of the Oregon Railway and Navigation Company's new steamship Columbia, in the SCIENTIFIC AMERICAN of May 22, special mention was made of the employment of the Edison electric lamp throughout the vessel. On the arrival of the Columbia at Portland, Oregon, July 26, the chief engineer reported that the system had worked with entire satisfaction during the whole trip in all kinds of weather. The ordinary skill of the engine room was sufficient for the management of the electric generators and the lights. This is the first application of small or incandescent electric lamps to the lighting of a ship's stateroom and saloons.

Trial of the Steam Catamaran.

The trial trip of the steam catamaran, Henry W. Longfellow, built at Nyack on the Hudson, took place July 28. The vessel behaved well; but the experimental propeller proved a failure. The partially submerged screw did not take hold sufficiently, and merely churned the surface of the water into foam without giving much headway to the boat. By substituting a submerged propeller with longer and broader blades, the builder is confident of attaining a speed exceeding twenty-five miles an hour.

A Lady Patentee Pleads her own Case.

We report in another column the suit of Helen M. McDonald *vs.* Sidenberg for infringement of her patent skirt protector. The case is interesting from the fact that the lady appeared in court as her own lawyer, and came off with flying colors, although she had for her legal opponent one of the ablest limbs of the law, Mr. Counsellor Dickerson.

A LARGE CARGO.—The cable steamer Hooper sailed from Boston, July 16, with probably the largest cargo that ever left that port. The Hooper carried 160,000 bushels of grain, 525 cattle, 1,450 sheep, 12,000 bags of flour, and about 400 tons of general merchandise.