

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....\$3 00
 One copy, six months, for the U. S., Canada or Mexico.....1 50
 One copy, one year, to any foreign country belonging to Postal Union 4 00
 Remit by postal or express money order, or by bank draft or check.
 MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

(Established 1876.)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 26 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Perus of subscription for SUPPLEMENT, \$5.00 a year, for the U. S., Canada or Mexico. \$6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.
 Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address, in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union eight dollars and fifty cents a year.

Building Edition of Scientific American.

(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.
 Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, \$2.50 a year. To foreign Postal Union countries, \$3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, \$5.00 a year. To foreign Postal Union countries, \$6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, \$9.00 a year. To foreign Postal Union countries, \$11.00 a year.

Export Edition of the Scientific American

(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. \$3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, SEPTEMBER 19, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

American Association meeting, the.....	231	Li Hung Chang at Niagara.....	231
Archæological notes.....	232	Mine timbering, heavy.....	236
Balloon experiences, war.....	232	Motorcycle race, the Providence.....	234
Bicycle gears, comparative.....	233	Niagara River, geology.....	234
Bicycles and road roads.....	233	Palmeri, Prof., death of.....	231
Bicycle prices in England.....	233	Patent and trade mark decisions.....	235
Bicycle race, a transcontinental.....	233	Railway, a single rail, Lartigue.....	237
Bottle, the magic.....	233	Railway fares, street.....	235
Buildings, measuring interior of.....	231	Rinderpest, danger of in.....	240
Calumet and Hecla copper mine.....	236	Russian purchases of machinery.....	232
Car, the American, in England.....	230	Salmon fisheries, Columbia.....	239
Car truck, ball bearing, O'Byrne's.....	234	Shiver.....	239
Cold storage, natural.....	234	Science notes.....	234
Cyclone in Pa.....	234	Scientific literature catalogue.....	230
Dam, the Genesee, project.....	234	Shipping, inland, German.....	230
Engines, large mining.....	236	Shoe and leather trades, inven- tions in.....	238
Exhibition, industrial, Berlin.....	236	Steamer, the largest merchant.....	234
Fire losses in 1895.....	240	Tatooling, origin of.....	236
Fish wheel for catching salmon.....	232	Telegraphing, Chinese.....	233
Fluorescent screen for X rays.....	232	Tooth brush, curiosities of the.....	233
Frogs and beetles (854).....	241	Tuberculosis.....	231
Goode, Dr., death of.....	235	Tzac Pokama, Guatemala.....	236
Houses, country, and wells.....	235		
Ink, Japan (856).....	241		

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1081.

For the Week Ending September 19, 1896.

Price 10 cents. For sale by all newsdealers.

	PAGE
I. CHEMISTRY.—A Completed Chapter in the History of the Atomic Theory.—By EDWARD W. MORLEY.—Conclusion of this classic paper on Prout's law and its definite disproof.....	17280
The Inspection and Sanitary Analysis of Ice.—By Prof. CHARLES L. KENNICOTT.—A contribution to sanitary chemistry.—The possibility of danger from impure ice.—2 illustrations.....	17285
II. EDUCATION.—The Schools of Ancient Greece.—A most graphic account of the life of ancient days, with contemporary illustrations.—2 illustrations.....	17283
III. ELECTRICITY.—Lightning Arresters.—By W. R. GARTON.—The protection of electrical installations from lightning strokes.....	17280
IV. ENTOMOLOGY.—The Army Worm.—An important New York Agricultural Station Bulletin, treating of the destructive plague and how to combat it.—2 illustrations.....	17282
V. HOROLOGY.—Clocks Provided with Automata.—An interesting subject.—Famous clocks of the world described and illustrated.—9 illustrations.....	17271
VI. HORTICULTURE.—A New Gooseberry.—The "Langley Beauty," of extraordinary size and perfection.—1 illustration.....	17283
VII. HYDRAULIC ENGINEERING.—Pumping Hot Water.—Paper on an interesting point of hydraulic engineering practice.—How the lift of a pump is affected by the heating of water.....	17272
VIII. MEDICAL AND HYGIENE.—Note on Treatment of "Black Eye".....	17276
IX. METALLURGY.—Chains and Chain Iron.—The subject of weldless chains and chains of special construction.—Continuation of this valuable paper.—5 illustrations.....	17273
The Art of Bronze Casting in Europe.—By GEORGE SIMONDS.—Continuation of this Society of Arts lecture.—The story of a famous statue.—6 illustrations.....	17278
X. MISCELLANEOUS.—Odometers.—A road measuring machine of early times; predecessor of the bicyclist's cyclometer.—An odometer for ships.—2 illustrations.....	17274
Engineering Notes.....	17277
Electrical Notes.....	17277
Miscellaneous Notes.....	17277
Selected Formulas.....	17276
XI. NAVAL ENGINEERING.—Experiments with Ship Models.—Recent tests of models for ships executed in England at the Barrow-in-Furness yards.—1 illustration.....	17275
XII. PHOTOGRAPHY.—Fixing and Washing of Paper Prints.—By A. HADDON.—A valuable and practical article on photographic printing.....	17275
XIII. PHYSICS.—Support for Arresting Vibrations.—The freeing of delicate laboratory instruments from vibrations due to external disturbance.—1 illustration.....	17280
XIV. TECHNOLOGY.—Black and Smoked Glass.—Formulas for making the "mix" for the production of different glasses.....	17276

THE BICYCLE IN ITS RELATION TO GOOD ROADS.

The successful transmission by bicycle relays of a war message and a post office dispatch across the continent, the details of which are given in another column, will always remain as a notable event in the annals of transportation. While the thirteen days consumed on the journey are full of dramatic interest, the performance itself was something more than merely spectacular; it has, as it was intended to have, a serious and practical value.

In the first place, the average speed of the relay, without taking into consideration the question of the roads and the weather, was highly creditable. It figures out as eleven miles an hour for the whole distance; and this speed was maintained night and day for nearly a fortnight, across three thousand four hundred miles of country, and involved the co-operation of over two hundred riders, with just as many transfers of the package, many of which were made remote from any habitation and in the dead of night. The speed would have been creditable even if maintained for a similar distance upon a continuous stretch of turnpike roads, and in favorable weather.

To appreciate the performance at its proper value it must be remembered that not more than one-fifth of the journey was made over roads that could be termed first class; that much of it took place over unballasted country dirt roads; and that for many hundreds of miles the riders had to wheel along the old emigrant trails which, fifty years ago, carried the ox team of the pioneers into the far West. Moreover, some hundreds of miles of the steepest hill climbing were encountered in the Sierra Nevada and Rocky Mountains, where the passes lie some seven thousand and eight thousand feet above the sea, and the surface of the mountain grade is roughened and rendered perilous by "washouts," loose rock, and gravel. To the difficulties arising from poor roads must be added those due to the weather, which on several days and nights was marked by rain storms, which turned the poor roads into mud, and rendered fast travel on the good roads impossible.

Taken altogether, this performance has lifted the bicycle once and forever out of the arena of mere pastime, and has established its economic value as a reliable means of transportation under the roughest conditions. It has proved its ability to carry an emergency dispatch over good roads for hundreds of miles at a speed rivaling that of any but the fast railroad trains, and it has shown that it can perform the same service over precipitous mountain trails, day and night together, at a speed which no relay of horses dare attempt.

In its bearing upon the science of war the transcontinental relay comes in as a strong vindication of the efforts of such soldiers as General Nelson A. Miles, who hold that the bicycle is destined to play an important part in military operations. It is now clearly proved that a system of military bicycle relays may be strung out, if need be, for thousands of miles, and that dispatches can be delivered from the Pacific to the Atlantic in but twice the time occupied by the regular mails; since it is certain that with such military roads to traverse as are to be found in France and Germany, the time of crossing the continent could readily be reduced to ten days.

While it is admitted that the chief lines of military communication in time of war will be the railroads and the telegraph, there will be many occasions when these will not be available; as, for instance, where they have been destroyed by the enemy in its retreat, or by a dash of cavalry upon the lines of communication. In such cases a trained bicycle corps could very rapidly establish a system of relays which, over good roads, could transfer dispatches at a speed of twenty miles an hour. Moreover, it frequently happens that two divisions of an army may be so placed that there is no direct railroad communication between them; whereas cross country roads can usually be found which would be available—as the recent transcontinental race has clearly shown—for the speedy establishment of a bicycle relay.

It should further be noted, in judging the value of the performance in question, that the relay was composed mainly of amateur riders, to whom the exertion of riding their relay, in such weather as they encountered, was a novel experience. In the case of a military relay of this kind the riders would all be professional men, trained for the work, to whom a ten mile ride at full pressure over rough roads and in driving rain would be nothing new; and from such a trained corps it would be reasonable to look for even better records than were accomplished in the recent memorable ride.

Perhaps the most important effect of this transcontinental relay is that it has shown in a most dramatic manner the necessity for better roads. The message was carried for hundreds of miles over what are known as dirt roads, which are periodically plowed and thrown up by farmers through whose lands they run. In dry weather they are deep in dust, which in wet weather is turned into slush and mud. Careful estimates have shown that the cost of a few years of this "tinkering" would suffice, if properly applied, to turn

these highways into first class macadamized roads, whose maintenance would entail but a tithe of the cost and labor which is being fruitlessly expended in the present methods.

THE AMERICAN CAR ON ENGLISH ROADS.

The intense rivalry between the East Coast and West Coast routes from London to the north of Scotland has led the officers of the companies which cover the former route to make a special bid for the summer travel this year. This did not come, as was expected, in the shape of an increase of speed, the running time of the rival roads being about the same this year as last; and though there are many features which indicate that the famous annual race will take place before the season is over, there is no evidence of it at the present writing.

The special attraction of the East Coast route consists of a complete train of eight long and heavy cars built upon the lines of the typical American car, and furnished with all the various details of equipment which characterize an express passenger train in this country.

How wide a departure has been made from the common English practice may be judged from the following particulars: The train is made up of eight cars of an average length of 67 feet, their weight being not far from 40 tons. This is more than double the length and weight of the standard English six wheeled coach. The cars are carried on six wheeled trucks. The Railway World (English) in describing the train says: "The train forms a compact whole, as the separate carriages are joined by the patent Gould combined vestibule, automatic coupler, buffer, and continuous platform, the side buffers and screwup couplings being abandoned in favor of appliances which have long been used in America. In fact, the train indicates throughout the triumph of American ideas." The cars are fitted with the raised clerestory roof, patent torpedo ventilators, double gas lights, Gould's steam heating apparatus, together with electric calls from each compartment. The English preference for privacy is shown in the retention of the compartment division of most of the cars, there being only one third class open car, with doors at each end and a passage down the center. The rest of the cars are called "composite corridor carriages," and each contains three first class and four third class compartments, a baggage room, and lavatories for each class. There is also a large baggage car with six wheeled trucks. The total length of the train is 530 feet, and it will carry about 300 passengers.

The weight of this train per passenger, however, is far greater than that of a train of the standard English cars, as was to be expected, and just here we find an explanation of the remarkable increase in size and power which is noticeable in this year's locomotives built for the Great Northern and Northeastern Companies. The former have turned out some grand locomotives on the general lines of Mr. Sterling's famous 8 foot driver singles, which have 19 by 28 inch cylinders and 8 foot 2 inch single drivers. Mr. Worsdell has also built some big machines with 20 by 26 inch cylinders and 7 foot 7 inch four coupled drivers, a full description of which will be found in our issue of August 22.

International Catalogue of Scientific Literature.

The international conference under the auspices of the Royal Society has been in every way a success from a scientific point of view, according to the London Electrical Engineer. The new catalogue is to begin with 1900, is to be in English, and is to relate to "pure" science only, applied science being excluded; but the limits are to be decided hereafter. In indexing according to subject matter regard is to be had, not only to the title of a paper or book, but also to the nature of the contents. Moreover, the catalogue is to comprise all published original contributions to the branches of science indexed, whether appearing in periodicals or in the publications of societies or as independent pamphlets, memoirs or books. The final editing and publication of such a catalogue is to be intrusted to a central international bureau acting under the direction of an international council, which will be responsible for the administration of the enterprise. Any country, however, which shall declare its willingness to undertake the task is to be intrusted with the duty of collecting, provisionally classifying and transmitting to the central office, in accordance with rules laid down by the international council, all the entries belonging to its scientific literature. The central bureau is to be in London.

Inland Shipping in Germany.

Improvements on the Oder have caused the amount of shipping at Breslau to increase from 125,000 tons in 1880 to 1,550,000 tons in 1894. The chief ports for inland shipping are Berlin, over 5,000,000 tons in 1894; Hamburg, 4,160,000 tons; Duisburg on the Rhine, about 4,000,000 tons; Mannheim, 3,662,000 tons; Magdeburg, 1,650,000 tons. All others have less than 1,000,000 tons.—Umland's Wochenschrift.