

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....
One copy, six months, postage included.....

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.00 each; additional copies at same proportionate rate. Postage prepaid.

Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.

Remit by postal order. Address

MUNN & CO., 87 Park Row, 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, with handsome cover, uniform in size with THE 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., 87 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 the world. Single copies 50 cents. 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., 87 Park Row, New York.

VOL. XXXIX, No. 1. [NEW SERIES.] Thirty-third Year.

NEW YORK, SATURDAY, JULY 6, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Aniline dyes, fixing [3].....	12	Inventions, new mechanical.....	6
Arctic expedition, Kithen.....	9	Ironclad, a Japanese built.....	5
Astronomical notes.....	7	Knives, plating [13].....	12
Belling cement for [7].....	12	Locomotive performances.....	3
Billiard balls, coloring [4].....	12	Magnet wire, resistance of [11].....	12
Blacking, 10.....	12	Magnesian salts, native.....	12
Boilers, steam.....	4	Milk, testing purity [2].....	12
Boomerang projectiles.....	4	Milling, American new process.....	7
Boring, deep.....	4	New England, what South owes.....	6
Brain feeding.....	8	Minerals, etc.....	12
Car Coupling, Paterson's.....	8	Nuisance, a great public.....	6
Car wheel, self-oiling.....	8	Palace car, a dry goods.....	8
Defying the burglars.....	8	Superior, the, at sea.....	12
Drilling machine, radial.....	8	Paste, non-soiling [14].....	12
Edison, Mr. T. A.	5	Patents, English to Americans.....	12
Electric light, new.....	11	Patent matters in Congress.....	3
Electricity, transmitting power.....	6	Positives, whitenin.....	5
Electrotypes of the brains.....	6	Quicksands, preventing [1].....	12
Electrotyping in copper [5].....	6	Shad hatching.....	12
Elevated railroad nuisance, the.....	2	Shanghai, the, at sea.....	12
Engine, condensing, at Paris Ex.*	4	Ship's log, the [10].....	8
Export edition for June.....	8	Ship designs.....	3
Flours which seem untruthful.....	8	Sludge acid, a defense of.....	7
Flour, packing [8].....	12	Spots, removing from cloths.....	7
Freight time, quick.....	6	Sun spots.....	7
Gas, effect of, on cotton goods.....	6	Telephone researches, Edison's.....	10
Glass, tridetic.....	6	Shanghai, the, at sea.....	12
Grease, removal from sinks [9].....	12	Torpedo, Whitehead.....	9
Iron, melting [12].....	12	Turkish bath, the.....	8
Indicator, electrical.....	2	U. S. Building, Paris Exposition.....	3
Industries, progress of Western.....	2	Water power, increasing.....	5
Industries, starting new.....	8	Whaling industry, decline of.....	8
Inventions, new.....	7	Wheat farm, Californian.....	9
Inventions, new agricultural.....	11	Wrench, improved.....	8

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 181,

For the Week ending July 6, 1878.

- I. ENGINEERING AND MECHANICS.—A Military Railway. Boats' Rigs. 9 figures. Fore and Mizzen Lug Sails. Sprit Sails. Bermudan Triangular Sails, and Yawl Rigs.—A Small Boat for Rough Water, with description, dimensions, and 4 figures, with a new and handy form of sail.—The Pieri Rifle. 7 figures.
- II. TECHNOLOGY.—Chromo-Photography. A new Albert-type Process that reproduces color in pictures.—Edwards' Enlarging and Copying Camera. 2 figures.—The Colloid-bromide Emulsion Process.—Direct Ink Printing from Glass Negatives. By HANS BRAND. The Use of Chalk in Dyeing Wool.—Manganese and Chrome Blues. Blue Alizarin.—Dyes and Colors. Lakes. Eosin Fixation of Cotton. Rose Bengale. Chrome Residues. Caulin. Sodio Silicate.—Portland Cement.—Seal Brown. Fast Black on Wool.—Scarlet on Cotton.—Light Brown-red on clean Wool.—Scarlet on Wool.—Orange on clean Wool. An important Trade-Mark Case.
- III. FRENCH INTERNATIONAL EXPOSITION OF 1878.—Tank Locomotive, Paris and Orleans Railway. Dimensions and 1 illustration. Swiss Tramway Locomotive. Engraving, with dimensions and description. New Portable Windmill. Engraving. 1 figure with description. 100 H. P. Horizontal Condensing Engine. 3 figures to scale, with description.
- IV. CHEMISTRY AND METALLURGY.—Contributions to Blowpipe Chemistry. By P. CASAMAJOR. A paper read before the American Chemical Society. No. I. New Blowpipe Bellows. 3 figures. Constant Pressure. Spring Catch. Water Trap.—Absorption of Carbonic Acid.—Determination of Vapor-densities.—Food.—Formic Acid.
- V. ELECTRICITY, LIGHT, HEAT, ETC.—The Magneto-electric Light. By CAPTAIN W. DE W. ABNEY, F.R.S. Experiments to ascertain the relation between the horse power expended, the light produced, and the number of revolutions of the armature, with observations of the actinic value of the light. Electro-harmonic Telegraphy. A paper read before the American Electrical Society. The Laws of the Pendulum. The Phenomena of Vibration in all Solids. Undulations of Matter. Waves of Condensation and Rarefaction. Mutual Convertibility of Vibrations and Undulations. Automatic Tracing or Registering of Vibrations on Paper. 7 figures. Jablochhoff's Method of Electric Lighting. Several Illuminators supplied from one source. 3 figures.—New Arrangement for Telephones. By BROWN AYRES. Telegraphy by Gas and Water Pipes and R. K. Rails. Hearing by the Teeth.
- VI. NATURAL HISTORY, GEOLOGY, ETC.—The Canons of the Colorado. From the Report of J. W. Powell, Geologist in charge of the survey of the Territories. The Grand Canon, the Kaibab Fault, the Unkarret Mountains, and other wonderful formations, and the agencies to which they owe their existence. Surface corrosion in moist and arid climates. Altitude, and how it determines the character of a region. With 8 engravings of remarkable scenery, island mountains, Glen Canon, 4 views of Grand Canon, Whipple's Grotto, Sumner's Amphitheater, etc. American Archaeology. Proposed illustrated work on American Archaeology by the Smithsonian Institution, including ancient mounds and shell heaps, cave and cliff dwellings, masonry, sculptured slabs or carved images, inscriptions and rock paintings, graves and cemeteries, aboriginal quarries and salt works, canoes, workshops, etc. Ancient roads or trails, and reservoirs and aqueducts. Information wanted on these subjects, and questions addressed to the inhabitants of America, with special memoranda and instructions to explorers. A call for specimens for the National Museum. Forest Tree Borer. By MARY E. MURTFELDT. The wood-boring beetles. The bark beetles. The wood weevils. The saw-horn. The long horn or Capricorn beetles. Insects destructive to hickory, walnut, oak, elm, beech, prickly ash, pine. The twig-girdler. How Nature checks the ravages of wood-boring insects. Parasitism. Flies, birds, and other exterminators. Protection of trees about dwellings.—The Fire Bush.
- VII. CHESS RECORD.—Biographical Sketch and Portrait, with one Problem, of G. N. Cheney, Syracuse, N. Y.—Rousseau as a Chess Player.—Frank Leslie's Problem Tournament of 1858.—Letter Problem.—Problem by J. H. Morrison.

Price 10 cents. To be had at this office and of all newsdealers.

THE ELEVATED RAILROAD NUISANCE.

The steam elevated railroads in this city are amply fulfilling the predictions of those who, like ourselves, have maintained that they were not suited to the needs of rapid transit here, and would, in all probability, be found an oppressive nuisance. On both lines accidents have recently occurred with alarming frequency. Two persons have been killed falling from the Metropolitan structure within the last few days. A workman had his head nearly cut off by a locomotive while painting the iron work. Sparks falling from a furnace-have set fire in one case to bales of cotton, and in others to awnings in the street below, and several persons have been struck and injured by objects falling from

merous runaways, and one person was seriously injured while riding on a street car through his leaning out and striking one of the supporting pillars of the road above. On the New York Elevated line a terrible disaster, which would have involved the precipitation of a whole train filled with passengers upon the sidewalk beneath, was so narrowly escaped that the public will feel a natural trepidation in passing over such portions of the aerial lines as are not provided with guard fences. Some mischievous boys, taking advantage of the ladders formed by the lattice-work pillars, climbed up to the track and placed heavy paving stones on the rails. The train was greatly shaken, but fortunately the guard rails kept it on the track and prevented its destruction. This is only the beginning of a probably long chapter of serious disasters, and it is suggestive to remember that the line on which nearly all have occurred is less than five miles long, and has been in operation but three weeks. How many people the elevated railroad companies propose to kill or injure daily after their whole forty miles of road is in operation, the long-suffering citizens of this metropolis will discover in course of time.

This, moreover, is but one class of the nuisances chargeable to the elevated system. Many of the most determined adherents of the Metropolitan road, while it was still in embryo, now are loud in their denunciations of the annoyances to which it subjects them. Nothing whatever has been done to reduce the deafening racket of the trains as they thunder over the resounding iron bridge, every sound-vibration of which is intensified and reflected downward by the huge sounding boards afforded by the car bottoms. Not content with throwing sparks, carbonic acid gas, and smoke into windows, necessarily kept open during the hot weather, the companies supply a detestable grade of coal especially rich in sulphur, and the result is that the unfortunate dwellers along the route, as well as the passengers, are nauseated by the stenches of sulphureted hydrogen. It is like putting a foul chimney in front of every one's bedroom window.

The management of the new line are profuse in promises of what is going to be done, and the urgent necessity for improvement begets the strong hope that their efforts will amount to something more than empty words. At the present time cars are run not nearly approaching sufficiency in numbers to accommodate the travel. And they are packed so full that the trip from terminus to terminus, about four and a half miles, frequently occupies, including stops, forty minutes. This is practically no improvement on the horse cars.

The only remedy for all these dangers and nuisances is to sink the tracks. This had to be done, and public opinion compelled it, on the Fourth avenue surface road, and the present underground line is a grand success. The Metropolitan road can put its iron tunnel under ground as well as above it. The present girders which support the rails can serve as the roof, and the track can be laid on the bottom of the cut. As matters stand now, the citizens of New York are receiving sparks, dirt, stenches, a deafening racket, dark, damp and obstructed streets, depreciated property, danger of trains leaving the track, and danger from runaway below, in return for valuable franchises for which not a cent is paid, too high rates of fare, and for the privilege of being packed in cars like cattle and slowly transported over a limited portion of the city.

STEAM BOILERS.

The relative advantages of steel and iron for boilers have been the subject of much discussion and experiment, by which the superiority of the former, in respect to strength and durability and the advantage in weight, has been clearly established; but its claims to superior economy do not seem to have been so convincingly advocated as to induce its substitution, in any considerable degree, for iron.

Most of the users of boilers are ready to admit that the steel boiler is more durable and less liable to fracture and explosion because of the homogeneity of the metal, but they are not sufficiently assured that these advantages offset its higher cost.

The hard times, too, intensify their disinclination to any change, and especially to the spending of time and money on experiments. Consequently iron boilers, notwithstanding their defects, still hold their prominent position as steam generators.

Knowing that suggestions which may result in greater safety to life and property, or to economy of manufacture, are of especial value now, and therefore pretty sure to be well received, we call attention to certain experiments that were made not long since, to determine the heat-transmitting powers of iron and steel boiler plates, feeling certain that our doing so will induce thorough investigation into the matter on the part of the manufacturers of each kind of plate.

Studying carefully the reports of boiler tests, and with some experience in such matters themselves, Messrs. Whelpley & Storer formed a theory respecting the causes of many of the discrepancies which were found in the services of boilers, and instituted a series of experiments to demonstrate its correctness.

Though conducted on a small scale the experiments were made with great care, and were repeated and continued through several weeks.

Thirteen pieces of boiler plate, of uniform thickness and a foot square, were obtained from manufacturers and boiler makers. Three of these were of Siemens-Martin steel and the others of iron.

to one face of each plate, forming a receptacle for a measured quantity of water.

Each plate, holding water of ascertained quantity and temperature, was then, in turn, placed over the carefully adjusted flame of an oil stove, and the time of evaporation noted.

As constant a temperature as possible was maintained throughout the experiment, and registered by a high grade thermometer, with bulb secured just under the lower surface of the plate.

All possible precautions were taken to secure like conditions in each case and to eliminate all causes of error.

In the first instance, each plate was tested in the condition in which it was received, then with the under surface brightened, and then blackened with lamp-black.

The mean of the results established that the Siemens-Martin steel possessed a heat-transmitting power—determined by evaporation of water at the pressure of the atmosphere—about 25 per cent higher than the mean of the iron plates; that the evaporation of the poorest steel plate was about 15 per cent higher than that of the best iron, and that the best plate of steel evaporated 40 per cent more water in a given time and under like conditions than the poorest of the iron.

The qualities of the steel plates were very nearly alike, while in the iron plates there were great variations in quality.

The cause of these differences was now sought by analyses of the plates, and Messrs. Whelpley & Storer held that absolute proof of the correctness of their theory was thereby established, to wit: that the presence or absence of non-conducting substances—cinder, oxides of iron, and other impurities—determines the heat-transmitting power, and consequently, in a great measure, the relative values of iron and steel for boilers.

The steels, owing to their mode of manufacture—the cinder separating from the molten metal—were practically free from non-conducting substances, while the irons, from which all such impurities cannot be eliminated in the process of manufacture, varied in their values according to the percentage of cinder and other foreign matters remaining in them. Of the irons the charcoal iron stood highest.

These novel experiments appear to demonstrate that, in conjunction with superior safety, great saving in fuel may also be assured by the use of steel for steam generators—a saving so considerable that it would soon offset the difference of cost between steel and iron.

PROGRESS OF OUR WESTERN INDUSTRIES.

The manufacturing interests of the West are remarkable in many respects, not the least remarkable being their rapid development and their dependence on patented inventions. A few years ago it was thought that the fertile States north of the Ohio and the Missouri were a paradise for farmers, but never could be other than agricultural in character. Even yet there are few persons who do not receive with surprise and incredulity any reference to that region as one pre-eminent for its manufacturing industries, notwithstanding the fact discovered by the census of 1870, that at that time the manufactured products of Ohio, Indiana, Illinois, Missouri, Iowa, Minnesota, and Wisconsin exceeded the agricultural products of those States by \$76,000,000 a year. Since then the manufacturing interests of the West have increased with a rapidity positively amazing; and unlike the great factories of the East, very few Western establishments are engaged on standard products made by time worn processes. In almost every case they are based on recent patents.

As an illustration of Western growth, take the city of Springfield, Ohio, to which the *Graphic* of June 10 gives a double page of illustrations. Fifteen years ago it was simply a pleasant inland town without any specially promising aspect. To-day it is one of the handsomest cities in the State, with a multitude of manufacturing establishments, turning out products to the amount of \$10,000,000 a year. These varied interests the *Graphic* reporter finds in a highly prosperous condition. "Neither the business men nor the manufacturers wear long faces. Their wares find sale in every part of the United States, and the 'Champion City' is well known as one of the leading manufacturing points in the West, and as having played an important part in securing for Ohio her enviable reputation throughout the world as the home of inventive genius and skilled mechanical labor."

The leading industry of Springfield is grouped around the champion reaper and mower, to the production of which a capital of \$7,000,000 is devoted, giving employment to thousands of men, requiring five mammoth manufactories to do the work, and all taxed to the utmost to meet the demands of their customers. In addition the *Graphic* enumerates nearly a hundred manufacturing establishments, some