

Scientific American.

ESTABLISHED 1846.

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

Club Rates.

Ten copies, one year, each \$2 70, postage included. \$27 00
Over ten copies, same rate each, postage included. 2 70

The postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

Scientific American Supplement.

A distinct paper from the SCIENTIFIC AMERICAN, but of the same size, and published simultaneously with the regular edition.

TERMS.

One year by mail. \$5 00
SCIENTIFIC AMERICAN AND SUPPLEMENT, to one address. 7 00
Single Copies. 10

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & Co., 37 Park Row, N. Y.

Subscriptions received and single copies of either paper sold by all the news agents.

VOLUME XXXV., No. 5. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JULY 29, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, N. Y. 72
Acrotherapy 71
Anchor lift, hydraulic 73
Answers to correspondents 70
Bale wires, machine for securing 70
Battery, new electric 67
Battery troubles 61
Beauty society, new 76
Birds, centenarian 76
Boilers, air and coal for 76
Boilers, high and low pressure 76
Bronzing castings 65
Buffa, polishing 73
Building materials, etc., Japanese 73
Business and personal 73
Car brake, improved 63
Caschadenim 63
Centennial, technical education 74
Chimney cowl, improved 76
Climbing a standpipe 69
Coal, etc., in Japan 76
Coal, formation of, anthracite 68
Compass, a Japanese 65
Corn cobs 65
Earth's axis, changes in the 63
Electricity, storing 66
Electric light on a steamer 72
Emperor's farewell, the 63
Engines and boilers, small 62
Facts and formulae 61
Fishes, voracity of 76
Frog, the 76
Gas pipe, the long 76
Glass, hard 69
Governor, new steam 69
Gravity instruments, ancient 66
Hammer, drop, direct-acting 65
Hay elevator and carrier 69
Heated terms, their causes, etc. 72
Hot weather peril, a 69
Hydraulic memoranda 67
Illinois Industrial University, the 69
Induction coils 63

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 31.

For the Week ending July 29, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876.—Illustrations of Torpedo Warfare, 1 engraving.—The Hell Gate Operations.—Sounding Machine.—Deepening New Inlet.—Galveston Harbor Improvements.—Military Bridges, 1 engraving.—Double Crane Swinging Bridge.—Netherlands Exhibit.—Printing Meteorograph.—Machine for Ruling Glass.—Astronomical Exhibit.—Method of Astronomical Measurements.—The Largest Grape Vine in the World, 1 engraving.—Portable Engines.—The Shapley Engine and Boiler, 2 engravings.—Steam Boilers.—The Babcock and Wilcox Boiler, 1 engraving.—American Iron and Steel Exhibits.—The Henderson Iron Process.—Watch-Making at the Centennial, the Mechanism in Detail.—Centennial Suggestions.—Russian Exhibits.—The Norwalk Pump, 1 engraving.—The Russian Fortress Gun, a new Implement of Warfare.
II. ENGINEERING AND MECHANICS.—New Combined Steam Engine and Vacuum Pump, 5 figures.—Surface Condenser for Steam Street Cars, 1 figure.—St. Gothard Tunnel.—Locomotive Connecting and Coupling Rods, by JOSHUA ROSE, 10 figures.—American Cast Iron Railway Wheels, Processes of Manufacture.—Repair of Steamer Colima's Crank Shaft at Sea, 9 figures.—Aerial Navigation.—The Gaging of Rivers, by D. F. HENRY, C. E.—Utilizing the Waste Heat of Boilers.
III. TECHNOLOGY.—Grinding and Polishing. By JOSHUA ROSE, No. 1, 5 figures.—Manganese Bronze.—Ornamental Inlaid Tables, 4 engravings.—British Frigate Hussar.—Science in Schools.—Imperial Celerity.—Chinese Money.—Amber.—Fatty Ink Photo Printing.—Photo Plate Cleaning Solution.
IV. ELECTRICITY, LIGHT, HEAT, ETC.—Lightning Freaks.—New Galvanic Battery.—Formation and Decomposition of Binary Compounds by Electricity.—Absorption of Nitrogen and Hydrogen.—Law of Dulong and Petit.
V. ASTRONOMY.—Reflector vs. Refractor.—Irregularity in the Moon's Longitude.—Improved Altazimuth Instrument.—The Light of Venus.—Specular Reflection of Venus.—Motion of Jupiter's Spots.—Large Solar Photographs.

The Scientific American Supplement

is a distinctive publication issued weekly; every number contains 16 octavo pages, with handsome cover, 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 SCIENTIFIC AMERICAN SUPPLEMENT will be sent together for one year, postage free to subscribers, on receipt of \$7.00.

TO SCIENTIFIC AMERICAN SUBSCRIBERS WHO WISH TO TAKE THE SUPPLEMENT.—A subscriber to the SCIENTIFIC AMERICAN may change at any time to the SUPPLEMENT, or may have both papers sent to him, by remitting to us the difference between the amount already paid for the SCIENTIFIC AMERICAN and the SUPPLEMENT prices above mentioned. Remit by postal order. Address

MUNN & CO., PUBLISHERS,

37 Park Row, New York.

All the numbers of the SUPPLEMENT from its commencement, January 1, 1876, can be supplied; subscriptions date with No. 1 unless otherwise ordered.

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

THE EMPEROR'S FAREWELL.

A scientific gathering of unusual importance—not because of what was done, but on account of those who were present—recently assembled at Chickering Hall, in this city. It was a special meeting of the American Geographical Society, called to receive three distinguished foreign gentlemen, the Emperor of Brazil, Dr. Petermann, the famous German geographer, and Dr. Berendt, the Central American ethnologist. Despite the torrid weather, all the scientific celebrities resident in this locality were present, and listened to an address on the "Centers of Ancient Civilization in Central America, and their Geographical Distribution," which really was very instructive and interesting. Dr. Berendt described, briefly, some of his expeditions into Central America; told how, in 1869, he discovered the site of the ancient city of Centla, and there found a host of curious objects made of that imperishable material, terracotta; and ended by an earnest plea for closer study of American archæology, and for the foundation of museums of relics of the ancient peoples which once occupied our own continent.

Judge Daly, the president of the society, then proceeded to that which was uppermost in everybody's mind, namely, the presence of Dom Pedro, and in a pleasant little speech contrived to say a great many complimentary but well deserved remarks regarding the distinguished guest.

Dr. Petermann's address, which followed, embodied mainly his impressions of this country, some of which, notably that which led him to eulogise our peaceful disposition, as shown by the fact of our having "only one man of war" in the navy, were rather amusing. But the eminent gentleman fairly beamed goodwill to and admiration of the United States.

The Emperor of Brazil was then elected to membership amid great applause. Dom Pedro arose, and with easy dignity advanced to the front of the platform, and spoke as follows:

"Although sincere gratitude's voice is always silent, I will not hesitate to utter my thoughts to the American Geographical Society for the honor it confers on me in the presence of men so prominent in geographical science, and such indefatigable explorers of a region where man, rivaling, as it were, with nature, feels that labor is his greatest glory and more solid base of happiness. In so solemn an occasion, however, it is my duty to express how in my country we prize geographical studies, which will bring to light its elements of wealth, and will secure for it—I speak as a Brazilian, but without partiality—a future brilliant and useful to all nations, with which Brazil has always endeavored to maintain cordial friendship. I trust the American Geographical Society will allow me to send here a feeling adieu to all the people of the United States, who welcomed me with so much kindness, and to explain to them at the same time how sorry I am that a motive, double regrettable, has not permitted my remaining longer among them, to see and examine as much as I desired, notwithstanding the means employed by this great nation to overwhelm time."

With these few words, Dom Pedro takes his leave of the United States. He has come among us as a quiet and unassuming gentleman, and has studied our country in a way that reflects honor upon himself and upon us. He has torn away the veil of romance which hedges about kings, and has showed us that the ceremony of royalty is an anachronism in the nineteenth century, and that true majesty, essentially democratic, suffers nothing by contact with the people. He has shown us how a great and independent ruler may be at the same time a humble and earnest student of science, as ready to receive information and knowledge from working men as from the most erudite of professors. Above all, he has shown us that the possession of education is deemed by him of loftier value than the undisputed ownership of a crown.

The great works accomplished by Dom Pedro during his reign were known to this country, and the welcome which has been extended him has been genuine and sincere. To their Godspeed, the American people now add their assurance of profound respect and cordial admiration—not for the Emperor of Brazil, but for Pedro of Alcantara. In their eyes, at least, the greatness of his station can add nothing to the respect now already secured by his qualities as a man.

The Emperor spent the closing days of his visit in this city inspecting the Hell Gate excavation, newspaper offices, public institutions, and other places of interest, with his usual celerity. Together with the Empress and his suite, he sailed for Liverpool on July 12.

HEATED TERMS—THEIR CAUSES AND DANGERS.

At the time we write, seventeen days of exceptionally hot weather have been experienced over the Northern States. The thermometer, despite a brief rainstorm within the past twenty-four hours, the first that has visited this region during the period above named, stands at 95° in the shade. It has stood at 90° and thereabouts for more than two weeks, and in this city has touched 102°. The most intense heat yet reported, however, has occurred at New Paltz, near Poughkeepsie, N. Y., where the mercury attained the unprecedented height of 112° in the shade.

Of course wise people have advanced innumerable theories relative to the cause of the present heated term. It is a fact just now that the sun spots are at their minimum, and hence the supposition that we get more heat from our luminary is generally favored. It should be borne in mind that the abnormally hot weather is not omnipresent the world over, and hence to believe that the sun is taking any extraordinary part in its production is to assume that that orb, by some process of selection, has chosen a very small portion

of the globe as the recipient of his scorching attentions. Besides, the fewer the sun spots, the greater the evaporative power of the sun, and hence the greater the production of rain, which depends on evaporation. Consequently, so far from the absence of sun spots tending to diminish rain, we should look to their non-existence as a reason for expecting increased rainfall. It is generally credited, also, that the Gulf Stream is moving nearer our coast, and hence the climate is gradually becoming warmer. This assertion is destitute of foundation in fact; but neither this notion, nor the one preceding, nor that involving spectroscopic observations of the sun and the discovery of immense masses of burning magnesium, etc., will ever cease to be credited as long as the daily papers find in their repetition such interesting matter to embody in their discussions of that universally interesting topic, the weather.

The truth is that hot spells like the present are due to local causes. Direction of the wind, barometric pressure of the atmosphere, hygrometric condition of the same, when acting in concert, are amply sufficient to account for increase of temperature over a few degrees; and by consulting the published weather reports and keeping a record of barometer and thermometer for his locality, the observer will soon recognize the especial conditions which underlie the extreme weather in his section of the country.

There are few parts of the world where so extreme a temperature as 112° is ever felt. According to tables given in standard meteorological works, it appears that 100° is exceeded besides in the United States and Canada, in Greece, parts of India, Afghanistan, Persia, Cape Colony, Desert of Sahara, parts of Egypt, Arabia, and the West Indies, and in Central America. In none of these localities, however, is there so wide a thermometric range as from 15° below to 112° above zero, or 127° Fah., as is the case in this and other Northern States. It is this wide variation that causes suffering, for the reason that we never become really acclimated to our own climate, or inured to all its vicissitudes. In common with all the Anglo-Saxon race, we possess the energy which is characteristic of dwellers in the colder portions of the globe, and this energy, intensified by American habits and peculiarities, knows no rest. Business and labor are carried on with unabated vigor, whether in the freezing cold of January or the fierce heat of July. We have no season devoted to general relaxation, as have nations under the tropics, though our summers may be as hot as theirs, nor are we able to adapt our habits to our climate, owing to the very uncertainty of the latter. Our weather is in reality a succession of surprises. We never know when to expect such visitations of heat as we are now undergoing, nor can we certainly count upon any period when excessive cold will prevail. Our "probabilities" system gives us an approximate idea of whether to expect rain or shine within twenty-four hours; but the boldest of weather prophets cannot predict whether the coming winter will be moist and open, or severely cold. We are subject, therefore, to sudden changes of temperature; and the natural effect of these is found in the succeeding increase in the death rate in populated localities.

For the week preceding the time of writing, the number of deaths in New York city is reported at 828, showing an increase of 122 over the previous week. Out of the above total, 541 represent children under five years of age; and a large percentage of the remainder includes, first, people who have become debilitated by the heat while suffering chronic disease, and second, the direct victims of sunstroke and exhaustion. In both cases the long continued prevalence of hot weather has resulted in a weakening of vital power, and this depreciation extends more or less over the whole community; so that when a person, even in full bodily health otherwise, is stricken down, his system is in a very poor condition to repel and recover from the shock. In a greater degree is this true of invalids and small children, whose hold upon life is at best but slight. Again, as we have said, sudden climatic changes are to be expected, and hence a hot spell of the present kind may terminate by a sudden fall of the mercury from 100° to 75°. We recently saw a descent of 11° produced in a less number of minutes by the springing up of a brisk easterly breeze. Now sudden mutations of temperature, especially downward, exercise a dangerous effect upon large numbers of persons, especially the aged and sickly, while even among robust people the unlooked-for change is apt to cause colds, pneumonia, and like maladies. It will be seen, therefore, that to maintain the health, whether in winter or in summer, in a climate such as ours, constant watchfulness is imperative. Thousands yearly die, victims to lack of precaution in guarding themselves against the ailments directly due to the vacillations of our most freaky weather.

LIVING ON FIFTEEN DOLLARS A WEEK.

A correspondent expresses a high appreciation of the SCIENTIFIC AMERICAN "as a paper for bosses," but submits that it would be worth much more to him and his ninety shopmates if it would only tell them how it is possible to live decently and educate a family on fifteen dollars a week.

We confess that the efforts of this paper have not hitherto been specially directed to the problems of domestic economy. It has aimed, not so much to teach the art of regulating one's household affairs, the art of spending money, as the more productive art of making money, by laying before its readers the widest attainable range of information where-with they may be enabled to turn their natural powers to the best advantage through the employment of newly discovered processes, the invention and use of wealth-producing and labor-saving devices, and every other means by which their intelligence, skill, and productive capacity may be in-