

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. 1. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JULY 1, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as 'Alloy for models', 'Answers to correspondents', 'Aquarium in New York city', etc., with page numbers.

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 1.

For the Week ending July 1, 1876.

TABLE OF CONTENTS.

Table listing contents of the supplement, including 'THE INTERNATIONAL EXHIBITION OF 1876', 'ENGINEERING AND MECHANICS', 'ELECTRICITY, LIGHT HEAT, ETC.', 'CHEMISTRY AND METALLURGY', 'AGRICULTURAL AND MISCELLANEOUS'.

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.—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.

NEWSPAPER and other publishers will be supplied with electrotypes of the Centennial Buildings and most of the other engravings which appear in the SCIENTIFIC AMERICAN and SUPPLEMENT, on very cheap terms.

For prices address the publishers, and indicate at the same time what engravings are desired, and the date of the issue in which they appeared.

NEW INVESTIGATIONS ON THE EARTH'S HEAT.

The theory ordinarily accepted as accounting for the creation and present condition of the earth is based on nebular hypothesis, and assumes that the globe, at one time gaseous, subsequently became molten, and is in that state now, with the exception of a comparatively thin crust, estimated to be about 60 miles in thickness.

We have said that our knowledge is but speculative, and its principal confirmation is found in the fact that, wherever excavations have been made, the increase of temperature noted is met with. From this, however, it follows that, if the interior of the globe is in a state of fusion, the relative distances necessary to descend in order to produce like augmentations of heat must be comparatively less as the center of the earth is approached.

Recent investigations by Professor Mohr, of Bonne, at the deepest well in the world, have adduced results altogether at variance with the preconceived estimates referred to above, and which, if hereafter substantiated in other localities, will tend to throw grave doubts on the igneous theory of the earth.

Table with 3 columns: Depth, Thermometer (Réaumur), Increase per 100 feet. Data points from 700 feet to 3,390 feet.

The third column decreases in arithmetical proportion, showing for each descent of 100 feet equal differences of 0.050° or 1/20° Réaumur, equal to 0.11° Fah. Applying this ratio to the depths below 700 feet, and between 2,100 and 3,390 feet, Professor Mohr forms a table as follows:

Table with 4 columns: Depth, Increase per 100 feet, Depth, Increase per 100 feet. Data points for depths from 100 to 3,390 feet.

Continuing this, the author finally determines that, at a depth of 5,170 feet, there will be no further increase of temperature, and that the heat indicated at that distance will be true to the center of the earth.

WORKING MEN'S HOMES.—SIR SYDNEY WATERLOW'S LONDON ENTERPRISE.

The problem of providing healthy and comfortable homes for the working classes is one with which students of social science have largely dealt in Europe, and one which, ere very long, must in this country demand earnest and thoughtful consideration. It is an undeniable fact that, so long as working men are compelled to live in the vicinity of squalor or filth, or are crowded into tenements where every sanitary precaution is neglected, their condition, both moral and physical, must suffer; and the legitimate result is the injury and depreciation of the class in whose well-being the prosperity of the community in great measure depends.

Relief from the overcrowded tenement is, perhaps, nowhere more needed than in New York. Rapid transit, when gained, will do much towards improving matters by opening cheap homes in the suburbs; but even then an immense number of people will still be obliged to live in the heart of the city. For them, and for their brethren in other populous localities, as well as for working men in factory towns, improved homes are urgently needed; and until the same are

provided, the epidemics which yearly afflict the denizens of tenements, and are due most frequently to foul and impure air, may be expected. Nor can we hope to materially decrease the number of the intemperate so long as the attractions of the bar room are set off against cheerless and comfortless homes.

There are two ways of accomplishing the required end, namely, either the workmen may cooperate or capitalists can promote the matter as an investment. Both plans have been successfully tried in England. It is certain that to wait for philanthropy to do the work is not wise. On one hand, philanthropists like George Peabody, or Peter Cooper, or Baroness Coutts are few and far between; and on the other, a majority of working men possess a feeling of independence to which the notion of accepting any benefit savoring of charity is especially repellent.

Now as to the two practical ways: The practice of cooperation has been a favorite one among English working men for many years, and it has worked marvelous results. It is based on the sound policy of cash payments, and dividing the profits of trade among members. Land and building societies are two of its forms. A working man desiring a house joins a society, who effect the lease for him. Instead of paying his landlord, he pays a certain subscription and interest to the society; and when his subscriptions are paid up, the association buys the house and conveys it to him. Those who do not purchase houses receive a dividend and bonus on their shares.

Passing to the second plan, this is also divisible. It may be carried out by individual employers for the benefit of their employees, or by corporations for the benefit of the whole working class in general. The former would be the course in manufacturing villages and towns, the latter in great cities like New York. We can best exemplify the working of both by example. In South Lancashire, the cotton spinning mills of the Messrs. Ashworth have been in operation for some seventy years. Owing a large tract in the vicinity, the proprietors have built complete villages. The cottages are of stone, two stories, and very comfortably arranged. The rentals are at fair prices. The men are paid regularly, and they in turn as regularly pay their rent. Schools are provided. In a word, so well organized and controlled is the great establishment that crime and misery are practically unknown.

So much for single-handed work. Great as are its results, they are exceeded by those achieved by the Industrial Dwellings Company in London. Here is a corporation based on a philanthropic foundation, but conducted on business principles, which render its working a model for future emulation. Some fourteen years ago Sir Sydney H. Waterlow (who, by the way, is now in this country, serving as chairman of the English jury on the Paper and Stationery Department of the Centennial, and to whom we are indebted for the following facts) erected at his own expense a block of dwellings in the heart of London, provided them with every convenience, and rented them to about 80 families at sums sufficient to yield a fair return on the outlay.

The buildings are of brick, ornamented with copings of artificial stone, made on the spot by the company, from Portland cement and coke breeze. This is easily and cheaply molded into tasteful forms, and is remarkably durable. The tenements, which are entirely separate, contain from two to four or five rooms; and every one, whether large or small, contains a compact little kitchen fitted with a range, boiler, clothes chest, and sink, and is provided with an abundance of water. The closets are detached from the tenements, and are separately ventilated. There is also a neat contrivance

for dust, which is thrown down a shaft to a receptacle in the cellar, whence it is removed. The height of the rooms averages 8 feet 6 inches, and the superficial area about 130 feet. The rent averages 50 cents per week per room. A suite of five rooms costs \$5.75. In other words, for about the same or a little less money than it costs in this city to hire a floor in a rookery, or in a building in which, in nine cases out of ten, sanitary laws are ignored, the working man may obtain a pleasant, comfortable home: better, it appears, in many respects than the French flats which rent here at from \$500 to \$750 per year, for a suite of rooms.

The effect of the above project has been a marked improvement in the moral, physical, and social condition of the working people who have availed themselves of the advantages offered, and a greatly diminished sick and death rate, as compared with London generally. It also has served to show how a work of genuine philanthropy and charity may be accomplished without impairing the self-respect of the beneficiaries, and may at the same time, afford a fair interest to the investor.

#### THE FARMER'S FOES.

The terrible pests which have wrought such ruin on the agriculture of whole districts of this country have appeared; and they have commenced their detestable industry with undiminished vigor. A correspondent in Iowa says: "Potato bugs are more numerous this year than they were last;" one in New Jersey reports: "Our State is particularly infested with potato bugs;" and similar accounts from Pennsylvania, Virginia, New York, and Massachusetts have been published in the columns of our contemporaries.

Professor Riley, State entomologist of Missouri, in his valuable report for 1875, states that, although the beetles were very numerous last spring, they became comparatively scarce and harmless, and did not become multiplied till the third brood had developed, by which time the crop was sufficiently matured to be out of danger. He reports that a beetle (*Lebia atriventris*, black-bellied lebia), half an inch long, has been seen to destroy the potato beetles in Maryland, and the common crow has been observed to devour them, and even to dig them out of the ground whither they had retired to hibernate.

Among artificial remedies and preventives, Paris green seems to maintain its lead, and some new facts as to its use have recently been published. The poison can be cheaply manufactured as follows, but much danger will be avoided and trouble saved by buying it already prepared of dealers. Dissolve 2 lbs. sulphate of copper in 1 gallon hot water, in a stone jar. In another jar put 1 lb. white arsenic and 2 lbs. pearl ash in 44 lbs. hot water, and stir till dissolved. Mix when needed in the proportion of 1 part of the former to 5 of the latter. Use with a sprinkler. Professor Riley states that the potatoes themselves show no trace of injury from arsenical poisoning; and he quotes Professor Kedzie to the effect that the soil is uninjured by the use of Paris green. Even water from the soil will not become poisonous unless the Paris green is used in excess of the requirements of insecticidal purposes.

The locusts are now commencing business, and giving, by their numbers and activity, some indication of the prospects of the season. Our readers are familiar with the doleful history of this plague, and of the devastation of large sections of Kansas, Missouri, Iowa, Nebraska, and other States by it. Professor Riley's observation of the nature and habits of the locust is laborious and careful; but the remedies yet discovered seem to be much out of proportion to the extent of the disaster. Destroying the eggs by shallow plowing, burning the unfledged young, cutting off the march of the adult insects by digging ditches, catching them in nets and seines, and burning sulphur seem to be useless against foes which occupy the land, not by counties merely, but by whole States, and which are as the snowflakes for multitude, and multiply with great rapidity. "Every bushel of locust eggs destroyed is equivalent to 100 acres of corn saved," says Professor Riley. The encouragement of game birds and sparrows is recommended, and the distinguished scientist believes that this will be found to be one of the best means of checking the increase of the species; but he justly adds that national means of averting the evil must be used, if anything can be done at all. To this end, our legislators may well address themselves; and the diffusion of sound practical knowledge on this subject is a work which Congress might take up in perfect assurance that it could not be more usefully employed.

#### A MISAPPLIED TESTIMONIAL.

One of those erratic geniuses with which every editor is more or less familiar, through his persistent seeking to ventilate absurd theories in our public journals, recently advertised a lecture in this city, on "Magic Reciprocals, a Mathematical Revolution." The announcement in the daily newspapers stated that the discourse was to be given at the request of a number of our best known citizens, headed by Mr. Peter Cooper and Mr. William Cullen Bryant; and at the door of the hall, a printed copy of the very flattering invitation, with signatures appended, was handed to every comer. While it is, of course, possible to doubt the authenticity of the document, the fact nevertheless remains that the statement that the lecture was asked for by these gentlemen was paraded in the papers repeatedly without eliciting contradiction from them. The result was that a goodly audience, including several scientific men, gathered to hear about the supposed discovery. Instead, they listened to a jumble of utterly absurd mathematical assumptions and misstatements, mixed with metaphysics and a notion of the

Darwinian theory apparently imbibed from some misinformed religious newspaper. The gist of the theory was the assertion that a point is the reciprocal of a straight line: supported by not a shadow of logical reasoning, but by a series of elaborate drawings in colored inks of right lines, forming figures somewhat analogous to the multifarious curves produced by the geometrical chuck used in engraving bank note plates.

While no one can dispute the right of anybody to believe and to promulgate any mathematical nonsense that may please him, many, we think, will, like ourselves, regret the support, tacit or open, perhaps unwittingly, afforded by the signers of the invitation. If these gentlemen did append their names, they have simply asked public confidence in a theory which a moment's examination must have shown them was ridiculous; if they did not, then a word of contradiction from any of them would have exhibited matters in their true light. Some of these gentlemen, who have done valuable service toward the spread of scientific knowledge, will, we think, agree with us in the view that their countenance of such proceedings, whatever their private opinion may be regarding the inventor, is to be deplored, since it tends to bring the cause of Science into disrepute through conveying to people the idea that false and unfounded theories have been regarded by the learned as of genuine scientific importance. At the same time, the effect also is to place the charlatan or visionary enthusiast on a level, in the minds of many, with those eminent scholars who have aided so greatly to disseminate useful information through the medium of the popular scientific lecture. It would be better if the indiscriminate giving of laudatory testimonials could be confined where the practice belongs, among the vendors of quack nostrums. Nothing is more certain than that, as regards mechanical inventions, reports of actual results through use alone are valuable; while true scientific discovery speaks for itself, and is superior to any one's opinion.

#### THE CENTENNIAL EXPOSITION.

A material change in the programme of the agricultural display has been made through the decision of the authorities that there shall be no competitive field trials of farm implements. As these trials have been announced in the prospectuses of the Exposition for the past two years, and as many exhibitors have made special preparations to undergo the tests, it certainly seems rather late in the day to abandon them now. The reason given is that such experiments, while they may demonstrate the excellent working of the apparatus, afford no idea of relative durability, a very important consideration to the user. It should be understood, however, that only the competition is ruled out. An exhibition of threshers and separators in operation at Schenck's Station, fourteen miles from Philadelphia, is now in progress, and on June 26 grass was to be cut, and on July 5 the wheat will be ready for reaping.

The attendance at the Exposition has been large latterly, and sufficient, if maintained, to secure its financial success. An unfortunate dissension arose a short time ago (but no longer exists, as we are informed), between the Centennial Commission and the Board of Finance, involving a conflict of the authorities, mainly regarding financial matters. Both boards have done good service, and it is greatly to be hoped that the organization and management may not devote to useless disputes the energy which has thus far contributed so greatly to the success of the enterprise.

#### THE BELGIAN EXHIBIT

In Machinery Hall is well calculated to excite general surprise at its extent when the small size of the country is considered, but is not, on the whole, to be wondered at when we recall the rapid progress in every industrial pursuit made by the Belgian people. A pair of Corliss engines built by P. Van Den Kerchere, of Ghent, are remarkable for admirable design and workmanship, and are considered by many engineers to be in some respects superior to the great Corliss machine itself. The largest apparatus exhibited is one for boring and tubing mine shafts and wells below the water level. Special interest attaches to the various railway exhibits, as the railroads of the country are among its largest sources of revenue. The different specimens of rails exhibited are of an improved pattern, and some are so arranged as to do away with the wooden sleepers common in this country. There are also new varieties of the street car rails, and new designs for holding such tracks in place. Next comes a large number of different sized railway buffers and springs, made of forged iron and used on railway cars to deaden the force of concussion. There are also numerous specimens of car couplings and wheels. Among the general machinery are two spinning machines with specimens of products, and a lift and force pump having a continuous piston motion, raising water to any height. There are, besides, specimens of connecting rods for engines, the process of bellied turning, an interesting model of a system of machinery for the utilization of greasy waste, from railroads, from suds of wool scouring, residue of palm oil, etc.

#### JAPAN.

We have already alluded in some detail to the fine Japanese display in the Main Building. The agricultural exhibit bears the same marks of completeness and admirable selection. All the various process of silk culture, from the hatching of the eggs to the production of the silk, are fully explained by models, charts, etc., from the government office for experimental silkworm breeding at Tokio. Here are shown the large hampers made of bamboo and used in carrying the mulberry leaves from the field to the place of rearing; also the boxes used for keeping the leaves fresh for two or three days for the young worms. Then come the

bamboo baskets for separating the parts of leaves of different weight, and the knives used in cutting them from the branches, together with the chopsticks for handling the worms, as the perspiration from the fingers is considered injurious to them. A very fine series of mulberry leaves and modes shows the process of cultivation in different soils; also specimens of insects injurious to the trees are also exhibited. In fine, the visitor has only to use his eyes to learn an immense amount of interesting information regarding the great silk industry of the Japanese empire.

Tea culture is illustrated by diagrams, showing modes of cultivation of the plant and specimens of the teas, together with examples of the method of packing. The manner in which the Japanese woods are displayed is especially good. Each particular variety, of the hundred or more exhibited, is shown both dressed and in a rough state, and beside it are placed portions of the bark and a few leaves from the tree. Each specimen is distinctly labeled with its name, an improvement which would greatly facilitate inspection if it could be carried out through all departments of the Exposition.

If any one is curious to know something of Japanese food, he will find displays of cured fish and hams, pickled fruits, sauces, and bottles of mineral waters. Some of the sauces which take the place of the omnipresent Worcestershire or catsup are produced from a variety of curious ingredients. Soy is made of fermented wheat and beans mixed with table salt; another, called nagaoka, is made of clean pounded barley, wheat, and soja hispida (a kind of bean), malted, with salt. These substances are brewed together, kept for about three years, and are then ready for use.

Bamboo is so extensively used in Japan that the large extent of the exhibit might well have been expected. From high poles, thick enough to form supports to a house and 20 feet in length, down to the most delicate wicker work and nets, the useful reed is presented in every conceivable form. A separate section is devoted to the display of shells, skins of fishes, horns, and feathers of various kinds; another is filled with barks and dye stuffs, another with a beautifully arranged collection of cereals. In fact, the Japanese display is surpassingly good; and if the visitor undertakes to study the resources of any one country as evidenced in the Centennial, he can devote himself to the examination of none with more pleasure and profit than to those of Japan.

#### IRON AND STEEL WIRE.

The visitor need not expect to find all the metal exhibits in Machinery Hall, although presumably this department is the proper place for them. Some of the finest are in the Main Building. The Washburn and Moen Wire Works, of Worcester, have erected a huge column 12 feet high, built of coils of clean new wire, each coil being of immense length. One shown to us weighs 525 lbs., and is over a mile long, and is made from American pig iron without weld or joint. The same concern exhibit ramrod wire in great bunches, a column of glistening broom wire, scores of coils of pin wire, steel furniture wire, belt hook wire, telegraph wire, clothes line wire, and whole heaps of wire for general purposes. Certainly few can realize to how many different ends wire is applied. Here, for example, is the fine steel material used in pianos, another variety for making wire gauze window screens, and a new invention for tying hay bales in lieu of the wooden withes now employed.

A magnificent specimen of forging is exhibited by Phillips, Nimick & Co., of Pittsburgh. Interspersed with saws and saw steel of all shapes, tastefully arranged upon the walls, are immense bars of iron, bent cold into knots as if by the hand of some giant. There are a great wrought iron expansion joint for water pipe, rolled in two half circles and welded so as to resist a tremendous pressure, Sligo Special, or SS, plates that have withstood pressures of 77,000 lbs. per square inch, and the Sligo fire box, 106 inches in diameter, having 64,000 lbs. tensile strength. Near by, in the display of Hussey, Wells & Co., of Pittsburgh, is a homogeneous crucible steel boiler plate of 76,000 lbs. tensile strength. Beside it is an axle which has had five blows alternately, first on one side and then on the other, by a drop hammer weighing 1,600 lbs., falling 25 feet. The metal is bent slightly, but not broken.

#### Stove Making in Canada.

The American Stove Manufacturers' Union held a meeting in Philadelphia on June 15 last, and the first business attended to was the appointment of a committee on patent laws. The subject of patent protection has recently been brought before the notice of the Union by the alleged piracy of American designs by Canadian makers. General Rathbone informed the meeting that he saw in the Main Building of the Centennial Exposition, in the Canadian department, a stove of his own pattern, another of a pattern belonging to the firm which the President, Mr. Jewett, represented, and many other standard American works. He said that stoves were sent to Canada, and casts made of the patterns, which the Canadian manufacturers obtained letters patent for and sold as their own designs; and not only that, but they had the effrontery to send the same pattern to the Centennial Exhibition to obtain premiums for originality of design. He hoped the matter would be brought to the attention of the Centennial authorities, and such measures taken as would prevent the Canadians from receiving rewards for designs and articles which did not now and never did belong to them. President Jewett held that it was a swindle upon the public. Mr. Spear had suffered in the same manner. It was agreed that the committee on patent laws draw the attention of Congress to the necessity for a treaty with Canada of a reciprocal character.