

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

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

By the new law, 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, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. 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.

If any of our readers fail to receive their numbers regularly; if the direction is not plainly written; if premiums are not received; or if there is fault of any sort at this office, we will thank our friends to send us postal card complaints, and repeat the same, if need be, until the remedy is effected. Do not hesitate to complain. We desire to keep all matters between ourselves and patrons right and satisfactory.

VOLUME XXXIV., No. 17. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, APRIL 22, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, New York... 263
Acetic acid, determining... 263
Aluminum, coating with... 264
Answers to correspondents... 267
Asbestos, the industrial uses of... 258
Asparagus, culture of... 262
Battery carbons, renewing... 267
Battery details... 267
Battery for decomposing water... 266
Battery for magnetic telegraph... 266
Battery, sesquioxide of iron... 264
Boilers, small... 267
Boilers, steam domes on... 263
Boilers, various forms of... 267
Bone black, estimating value of... 267
Business and personal... 267
Capsuling medicaments... 259
Cement for sponge and metal... 266
Cement to harden quickly... 267
Centennial, free passes at the... 267
Centennial, horticulture at the... 267
Centennial, Rodman gun at the... 267
Cisterns, concrete floors to... 267
Coffee, sham... 263
Copper solutions... 267
Cure in a ball, the largest... 267
Cutting metals with iron disks... 267
Dental engine, electro-magnetic... 266
Dyeing wood... 266
Eggshells, utilizing... 266
Electric clock... 266
Electric lamp lighting... 267
Electric light... 266
Electric resistance... 266
Electric shocks from coils... 266
Enameling machine, cloth... 267
Engine, speeding an... 267
Exhaust pipes, vacuum in... 267
Filters, river side... 267
Fire bend, checking the... 267
Fire fish, the... 267
Galvanized iron... 267
Gas machines... 267
Glass, use of by the Chinese... 263
Gold mining in the Black Hills... 262
Grain cleaner, improved... 263
Gurnard, the filamentous... 263

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 17.

For the Week ending April 22, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876, with 8 engravings.—The Australian Geological Exhibit, 1 figure.—Arrival of Foreign Exhibits, 1 engraving.—The Spanish Building, 1 engraving.—The Old Building, 1 engraving.—The Michigan Building, 1 engraving.—Exhibition Notes.—The English Buildings.—The Centennial Opening.—Australian Copper Mining Machinery, 3 figures.
II.—MECHANICS AND ENGINEERING. With 10 figures.—Cornish Pumping Engine, Hull, with two pages of engravings.—Clothing for Boilers.—Smoldering Fires in Mines.—Flexure of Beams.
III.—TECHNOLOGY. With 10 figures.—Mordants. Preparation of Photo Paper.—Purple Ink for Linen.—Waxing Silk.—Removal of Varnish from Negatives.—Oil in Lubricating Machines.—Manufacture of Alum.—Manufacture of Blotting Paper.—Black Ink.—Manufacture of Sulphuric Acid, 3 engravings.—Petroleum Trade of the United States.—Remarkable Photographs, the Largest in the World.—Photo-Portrait and Frame at Once.—Vegetable Silks.—How to Cast Medals, Vases, and other Ornamental Objects, 6 figures.—How to Make Easily Fusible Alloys.—Turf Flower Pots and Vases, 4 figures.
IV.—ELECTRICITY, LIGHT, ETC. With 6 figures.—The Gramme Magneto-Electric Machine, 2 engravings, showing Construction.—The Earth's Magnetism.—Mechanical Action of Radiation, by PROFESSOR L. C. COOLEY.—New Ebulioscope, 4 figures.—Increasing the Induction Spark.
V.—CHEMISTRY, METALLURGY, ETC.—Manganese in Cast Iron.—Titanium.—Recent Metallurgical Processes.—Coal Dust and Explosive Fire Damp.—Iodine and Bromine in Fresh Water Plants. Aniline Black.—Spectroscopic Method for Gases.—Spectrum of Nitrogen.—Transformation of Cane Sugar.—Chemical Changes by Light.—Action of Ammonia upon Rosalind.
VI.—NATURAL HISTORY, ETC.—Geyser in New Zealand.—The Sub-Walden Explorations.—Foggy Graveyard.—Anthracite coal from Spring Water.—Light and Lunacy. Discoveries in Egypt.—Limits of Perception in Regard to Musical Tones.—The Mamertine Prison, Rome.—South Park, Colorado.

The SCIENTIFIC AMERICAN SUPPLEMENT is 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 SCIENTIFIC AMERICAN SUPPLEMENT will be sent together for one year, postage free to subscribers, on receipt of \$7.00. 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 may date with No. 1 if desired. Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 6 cents.

The reader's attention is called to the advertisement of Mr. Fredolin Smith's patent bent wagon hound, on the back page of this paper. This is claimed to be a useful and excellent invention, calculated to be of much economical value to carriage and wagon builders. It relates to a construction of hounds whereby they may be better and stronger when bent than before, and whereby they may be formed without spoiling so many in bending as is unavoidable when they are bent in the ordinary manner. J. H. Cole, of Tiffin, Ohio, is the sole agent of this patent.

A WOMAN'S WORK FOR SCIENCE.

"Great men and great causes have always some helper of whom the outside world knows but little. Sometimes these helpers have been men, sometimes they have been women, who have given themselves to help and to strengthen those called upon to be leaders and workers, inspiring them with courage, keeping faith in their own idea alive, in days of darkness 'when all the world seems adverse to desert.' Of this noble company," says her biographer, in a volume of recently published memoirs, "Caroline Lucretia Herschel was one;" and the record of a life which lacked but two years of a century in length offers a bright example of what a woman's work may be, when an intense personal sympathy and affection enlist her powers. It was to the advantage of Science that those powers were directed to its furtherance: for had Sir William Herschel, unstrengthened in his purpose by her, remained the humble music teacher, he would have passed to posterity as the composer of a few mediocre symphonies, and not as the discoverer of Uranus; she herself, at the close of a vocalist's career, would have sunk into oblivion, and Sir John Herschel, the son of the one and nephew of the other, doubtless would have followed his father's lowly path. It is only necessary to remember the inestimable value of the labors of these three persons in the cause of the grandest of the natural sciences, to realize how great would have been the loss to mankind had the three lives passed away unmarked and unknown.

The life of Miss Herschel was for nearly half a century so closely linked with that of her brother that, in reading her own story of her discoveries, it is difficult to believe that she speaks of her own original labor, so modestly and withal so persistently does she hold herself forward as "merely the tool" which Sir William shaped to his own use "for minding the heavens." It was in 1772, at the age of 22 years, that she left Hanover, her native country, and joined her brother in England, where she found him a hardworking teacher of music, with but a few hours at his disposal to devote to the study of astronomy, a work in which his whole soul was fast becoming absorbed. Insufficient mechanical means aroused his inventive genius, and he had begun to contrive a telescope of eighteen or twenty feet in length. "I was much hindered in my musical practice," says Miss Herschel, "by my help being continually wanted, and I had to amuse myself with making the pasteboard for the glasses which were to arrive." This "pasteboard" was the first crude model of the great instruments subsequently made by her brother, whose then early attempts soon led him to seek larger mirrors, though none were to be had. By good fortune, he obtained the tools of a Quaker resident at Bath, who had made efforts in a similar direction, and forthwith, "to my sorrow," says the sister, dropping the astronomer for the housekeeper, "I saw almost every room turned into a workshop."

In those days the grinding of specula was done by hand, there being no accurate machinery for the purpose. The tool on which they were shaped having been turned to the required form and covered with emery and water, they were ground on it to the necessary figure and afterwards polished with putty or oxide of tin. To grind even a six inch speculum was no small labor; and some idea of the work that William Herschel undertook may be gleaned from the fact that once, in order to finish a seven foot mirror, he would not remove his hand from it for sixteen hours together, while Caroline says, "by way of keeping him alive, I was constantly obliged to feed him by putting the victuals in bits in his mouth."

At this time the name of William Herschel was fast becoming famous, mainly through his repute as the inventor of instruments of unheard-of power. Now (1781) came the discovery of Uranus, and a few months later the election of the discoverer into the Royal Society. King George III, whose army in America just then was meeting reverses, commanded the presence of the astronomer at court, and solaced his royal disappointment over the probable loss of his colonies by frequently gazing at the new planet, which had been christened Georgium Sidus, after him. Herschel, however, did not fancy following the king about with telescopes; "company is not always pleasing," he naively writes, "and I would much rather be polishing a speculum": but despite this distaste, he chose to be Astronomer Royal at \$1,000 a year, rather than go back to music teaching for a livelihood. "Never bought monarch honor so cheap," caustically said Sir William Watson, when the meager stipend was granted.

"I found," says Miss Herschel, "that I was to be trained for an assistant astronomer, and by way of encouragement a telescope adapted for sweeping was given me. I was to sweep for comets, and to write down and describe all remarkable appearances I saw." Her brother, near her, meanwhile devoted himself to his magnificent observations on the new planet, the nebula, and the double stars; and to Caroline's labors with her instrument, which consisted mainly in searching for nebulae to be marked in her catalogue, were added the duties of assisting him "either to run to the clocks, to write down a memorandum, to fetch and carry instruments, or measure the ground with poles, etc.": certainly enough tasks without the further implication of the *et cetera*. Often she remained patiently beside Sir William, jotting down his rough notes, when the weather was so cold that the ink froze in the bottle; and then before dawn she would take the manuscript to her cottage, and by morning have ready a fair copy of the night's work. Occasionally her brother did not need her services; and at such times she prosecuted the observations that resulted in the discovery of the comets of 1786, of 1788, of 1791, of 1793, and of 1795 (the last now known as Encke's) and rediscovered three previously found comets. In 1783-4-5, she produced a new catalogue of a thousand stars; in the five years following she added a thousand more stars to

the list; and she discovered the places of five hundred others between 1788 and 1802. Meanwhile she studied mathematics, her brother aiding her only by asking difficult questions at the breakfast table, the answers to which she carefully preserved. She was thus enabled to help him in his numerical calculations, while she unceasingly ministered to his wants during the construction of the famous 40 foot telescope. She tells us in her letters some pleasant anecdotes of that great instrument: how when it was completed a large company, headed by Sir William, entered its huge tube and sang "God save the King." Later King George himself walked through it, followed by the Archbishop of Canterbury. The prelate was portly, and the road was not an easy one for him, so the king graciously extended his hand to assist him, saying "Come, my lord bishop, I will show you the way to heaven."

In 1822, Sir William Herschel died, and the faithful sister returned to Hanover, almost brokenhearted with grief. She did not, however, relinquish her beloved labors, but at the age of over seventy years began the laborious reduction of the places of 2,500 nebulae, presenting in one view the results of all Sir William's observations of those bodies up to the year 1800. It was an instance of touching fidelity, this labor in her old age, for the dead brother for whom she had so earnestly worked during his life. The task was completed in 1828, and won for her wide renown. The twenty years yet remaining to her were passed in Hanover, where from her quiet seclusion she watched the growing fame of her illustrious nephew, aiding him by her mature advice, and welcoming, with an enthusiasm equal to his own, the results of his great efforts. In January, 1848, that long and useful life peacefully and tranquilly closed.

THE PATENT OFFICE APPROPRIATION.

No better evidence of the progress of invention is needed than the fact that the receipts of the Patent Office for the month of March were the largest ever known. They exceeded eighty thousand dollars, which is in excess of the same month of last year by ten thousand dollars; and Congress will act very unwisely if it reduces the appropriation for this department. Such a step would necessarily decrease its working force, which is now hardly sufficient to permit prompt action and careful research on the part of the examining officers. The salaries of the examiners are at present so small that it is impossible to retain for a great length of time those best qualified for the work; and the prosperity of the Patent Office department and the interests of inventors depend largely upon the efficiency of the Commissioner and the examiners, the latter of whom decide upon the patentability of all inventions submitted to the Office.

Commissioner Duell has proved himself one of the best executive officers that has presided over the Patent Office since Judge Mason was Commissioner; and the liberal construction of the laws, inaugurated by the last named gentleman, allowing inventors to receive patents for improvements without regard to the degree of invention, is the wise policy of the present Commissioner. This liberal interpretation meets the approbation of inventors, and at the same time largely increases the revenue of the department.

Since the above was in type a correspondent of one of our daily papers—the Graphic—writes from Washington that, "since it has become generally known that our reform House of Representatives has proposed cutting down the appropriation for the support of the Patent Office, every mail has brought to Commissioner Duell letters, from inventors, manufacturers, and business men in all parts of the country, protesting against such retrenchment. It should be constantly remembered that the overburdened taxpayer, about whose sad condition such jeremiads have been chanted in Congress and on the stump, does not pay anything to support the Patent Office. That institution is self-supporting, and, as I showed in a former letter, has over \$750,000 to its credit in the Treasury. It is carrying retrenchment a little too far to deny the inventors of the country speedy and intelligent action at the hands of the government while taking their money for it. In some of the communications sent to the Patent Office, the writers say that, if Congress cuts down the salaries in the way proposed by Randall's committee they will favor the starting of a subscription to pay the examiners proper salaries, so that the Office may not lose their services."

The latter named proposition is, of course, not feasible, and those who have written letters offering to subscribe for such an object cannot but know that no employee of the Patent Office would be allowed to receive any contributions from inventors or others doing business with the department; but that such a thought has entered the heads of a considerable number of persons indicates the objection, felt by persons interested in the prosperity of the Patent Office, against Congress reducing its appropriation. We are not among those, however, who think that there is no room for further economy or improvement at the Patent Office. We hope that Congress will carefully look into the institution, and faithfully do whatever may be necessary to increase its usefulness and efficiency.

STREET TELEGRAPH LINES.

In this misgoverned city of New York, the constant extension of the telegraph has resulted in the lining of all our principal streets with unsightly wooden poles, and the cry is "still they come." The sidewalks are obstructed by them, while the lives and limbs of citizens are more or less endangered by the poles and wires. In winter, especially, the ice-covered wires frequently break, animals are maimed, drivers of vehicles sometimes thrown, pedestrians tripped, etc. In London the wires are, to a large extent, carried underground. The portions above ground occasion more or less trouble. We have before us the details of three serious accidents