

Scientific American.

ESTABLISHED 1845.

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
Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

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 SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid to subscribers. Single copies 19 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., 37 Park Row, N. Y.

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

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 20. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, MAY 19, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Air compressor, high speed*.....	312	Made lantern, light for (4).....	315
American inventor, the.....	307	Man, marvels of.....	310
Annotte, extract of (27).....	315	Memory, culture of the.....	312
Answers to correspondents.....	315	Mill spindles, bearings for (6).....	315
Arsenite of copper (25).....	315	Mirrors, silver from (28).....	315
Balloons, hot air (11).....	315	Moles.....	306
Basewood, bending (19).....	315	Mosquitoes, to prevent (9).....	315
Battery, a simple (41).....	316	Motors, small (21).....	315
Boiler difficulty, a (18).....	315	Navies, the Russian and Turkish.....	304
Boiler for small engine (38).....	316	Neuralgic storm belts.....	304
Boilers, cast and wrought iron (23).....	315	New books and publications.....	313
Boilers, lugs in (11).....	315	Papyrus or paper reed, the*.....	307
Boiling water, vacuum (24).....	315	Patent decisions, recent.....	313
Business and personal.....	315	Patents, American and foreign.....	313
Capillary experiments*.....	306	Patent, official list of.....	316
Carbons for batteries (42).....	316	Phosphorus on gun sights (17).....	315
Cars, heating with steam (16).....	315	Photographic improvements.....	304
Coral, artificial.....	308	Potash, acid.....	305
Correspondence, Washington.....	308	Pipe tongs, wrench, etc.....	310
Earth's retardation, the (22).....	315	Post office, N. Y., accident in.....	308
Eggs, preserving (12).....	315	Potato bug, new remedy for.....	308
Eggshells, hardening (32).....	315	Pump bucket, rubber*.....	310
Electric annunciators (34).....	315	Rosin, purifying (31).....	315
Electric compound.....	315	Saws, thin (10).....	312
Engines, high pressure (8).....	315	Sea water on lead, action of.....	307
Explosive, a new.....	304	Secretary bird, the.....	311
Fireproof walls.....	307	Setting of soil (10).....	315
Fish, fresh and salt water.....	305	Siphons in mines (25).....	315
Fish scaler, improved*.....	306	Spindles, welding (36, 40, 41).....	316
Fishing, extraordinary.....	306	Stains, ink (29).....	315
Fog horns, blowing (35).....	316	Steam cars vs. horses.....	308
Galvanic shocks from relays (48).....	316	Steam engine, portable*.....	303
Gardening all the year round.....	307	Sunlight, the synthesis of*.....	306
Gilding book covers, etc. (26).....	315	Synopathy, helpful.....	303
Gravity and centrifugal force (15).....	315	Tanning materials, scarcity of.....	311
Great Eastern, the, a meat ship.....	305	Tarantula (37).....	310
Heat and pressure of steam (8).....	315	Telegraphs, underground.....	311
Heating pipes, steam (30).....	315	Telescope eyepieces (7).....	315
Horse, strength of a (17).....	315	Tin and copper, separating (29).....	315
Horses' feet, care of.....	312	Umbrellas, past and present.....	312
How to do it and how not to do it*.....	309	Ureolipide, water (20).....	315
Ink, indelible, with oil (39).....	315	Vermilion, removing (2).....	315
Ink, stencil (27).....	315	Violins, grooves on, etc. (39).....	316
Kingfisher, a remarkable*.....	311	Wages in Scotland.....	316
Laughing jackass, the*.....	311	Walnut furniture, polishing (28).....	315
Lead pipes nearly harmless (1).....	315	Water boiled in a sieve.....	306
Lithographic stones, dressing*.....	308	Weighing instrument, new.....	305
Live long, how to.....	308	Woodwork, cleansing the.....	311
Lost his ambition.....	305		

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 72,

For the Week ending May 19, 1877.

- ENGINEERING AND MECHANICS.**—On the Minute Measurements of Modern Science. By ALFRED M. MAYER. With 5 illustrations. The Vernier Scale; how to make and read it. Mayer's new Vernier Microscope. Pipes for Gas and other purposes. 5 illustrations. Coal Mining at Steubenville, Ohio. The Babcock and Wilcox Sectional Steam Boiler. With dimensions, construction, and 3 engravings. Steam Boiler Explosions during the past six months; being a catalogue and brief description of each accident, locality, etc. The New United States Iron Landing Pier, Delaware Bay, New York Harbor; built on Iron Screw Piles. Designed by Lieut. Col. J. D. KURTZ, U. S. Corps of Engineers. A full history, with Map, Description, Details, and Scale Drawings. By A. STERRE, C. E., Assistant Engineer of the works. A valuable and important paper. Two pages of engravings.—Recent Improvements in Steel Ship Building, exhibiting the economy and advantages of this important method. Dynagraph Railway Experiments.—Preservation of Wooden Railway Ties; showing the life of various preserved Ties on European railways, and the different modes of impregnation. New Method of Cooling Cannon and other large Castings. By JNO. S. ROBINSON.
- TECHNOLOGY.**—On the Dyeing of Leather. By M. W. EITNER. Presenting a number of valuable recipes and directions.—Transfer of Negative Films to paper.—The Fish and Fisheries of Norway, with an account of the production of Cod Liver Oil.
- ELECTRICITY, LIGHT, HEAT, ETC.**—Improvement in Generating Electric Currents, by ALEXANDER GRAHAM BELL; 4 figures. Production of the Lime Light without Oxygen Gas. Curious Results in the Production of Heat.—A Boiler with an Open Bottom.
- CHEMISTRY, METALLURGY, ETC.**—The Chemistry of Gas Manufacture, by A. VERNON HARCOURT, F.R.S., one of the Metropolitan Gas Referees. An interesting and valuable paper; showing the Origin of Coal. How Coal was Formed. Greatest Depth for Coal. Changes in Coal by Heat. Oil from Coal. Gases from Coal. Other Substances Derived from Coal. Varieties of Coal. Coal Tar and its Remarkable Products. Naphtha. Benzol. Creosote. Anthracene Oil. Pitch Coke. How Aniline is Produced. Mauve. Anthracene. Natural Gas in Iron Making, as practised in Pennsylvania. Orthoclase or Common Feldspar.—Meeting of the German Chemical Society, Berlin: Notices of several valuable papers, by Professor A. W. HOFMANN and other prominent Chemists.—Oxygen of the Air, by Professor LEEDS.
- NATURAL HISTORY, ETC.**—Ancient and Extinct British Quadrupeds, by A. LEITH ADAMS, M.D. An interesting paper.—Protective Mimicry of Bats.—Nest of the Aye-Aye.—Nest of the Gourami.—Electrical Bels.—Bee-eating Toads.—Cameron's Journey across Africa, with 5 illustrations.

TERMS.—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, five dollars. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, seven dollars. **CLUBS.**—One extra copy of the SUPPLEMENT will be supplied gratis for every club of five SUPPLEMENT subscribers at \$5.00 each.

All the back numbers of the SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price 10 cents each.

NOW READY.—The SCIENTIFIC AMERICAN SUPPLEMENT for 1876. Complete in two large volumes. Over 800 quarto pages; over 2,000 engravings. Embracing History of the Centennial Exhibition. New Illustrated Instructions in Mechanical Drawing. Many valuable papers, etc. Price five dollars for the two volumes, stuffed in paper; or six dollars and fifty cents, handsomely bound in stiff covers.

RECENT IMPROVEMENTS IN PHOTOGRAPHY.

Two interesting improvements, of promising practical importance, have of late been made public. The first relates to the production of negatives, for gallery and other work, without the use of the nitrate of silver bath.

The common method of photography, that universally practised in all galleries for portraiture, and for the best outdoor work, is known as the wet plate process. It consists in sensitizing the collodion plate by dipping in a liquid charged with nitrate of silver. The sensitization is effected in about three minutes' time; the plate is then withdrawn from the bath, quickly placed in the camera, and the picture taken and developed before the plate has time to dry. When all the chemicals are in good order, the bath pure, the exposure rightly timed, and the development skilfully done, the most beautiful results are produced. Indeed, there seems to be no room for improvement in picturesque details, as realized by the best wet plate operators.

But the method is attended with many inconveniences and irksome details. The gallery photographer must keep in readiness a first-class bath, the purity of which is lessened by every plate that goes in; and the bath soon requires renovation. The plates cannot be prepared and sensitized so as to be ready for use in advance of the opening of the day's business, but must be prepared and developed after the customer comes. Should the negative prove unsatisfactory, a new plate must be prepared and developed; and thus the bother of the plates involves the loss of so much time that the operator has little chance to consider the best positions for his subject or to study the artistic accessories that go to make up a finished picture. For outdoor work, wherever the photographer goes, he must lug his bath along, even to the mountain top, and must there have a dark tent, and water for washing and developing; otherwise his efforts are fruitless. For several years past it has been the study of photographers to discover a reliable method of preparing highly sensitive plates without the use of the bath—a method by which the plates could be used when dry. Among the results of these efforts are a variety of dry plate processes, some of which, in the hands of skilled operators, yield excellent results. But nearly all of them have proved less sensitive or less excellent in their results than the wet process; and none have been able to compete with the latter for portraiture or gallery work.

The French Photographic Society in 1876 offered a prize for the best dry process which should unite rapidity with all the other qualities that go to make a good negative. The competition was closed in December last, and the jury have recently awarded the prize to Mr. Alfred Chardon. The process appears to have advantages over some of its predecessors, but there are inconvenient details about the development and some uncertainty in the summering and wintering of the emulsion; while the prepared plates require twice as much time for taking the picture as the wet plate. Moreover, the process is not suitable for the ordinary routine work of the gallery.

The author of the new process which we have now to describe, and to which we would direct the attention of photographers as a complete and perfect substitute for the wet process, both for indoor, gallery, portrait, outdoor work, and all descriptions of photography, is Mr. Henry J. Newton, of this city, President of the Photographic Section of the American Institute.

We have seen the process worked under the author's hands and examined some of the results. We believe that practical photographers, when they come to examine the negatives and prints, will agree with us when we say that they are unsurpassed by anything as yet produced by the wet process. They will also agree with us that Mr. Newton's process is simpler, quicker, easier, less expensive, and more certain in the excellence of results than the old method. Moreover, for gallery and outdoor work, it presents the striking advantage of enabling the photographer to prepare in advance a stock of sensitive plates, and of keeping them on hand ready for instant use when wanted.

The Newton is an emulsion process. The silver is mixed with the collodion, which remains good for use at any time within a year or more. A glass plate is flowed with this collodion in the usual manner; the plate is then dipped in water; it is then ready for use either before or after drying. The picture being taken, it is developed by simply flowing the plate, in the ordinary manner, with a solution of carbonate of soda and pyrogallie acid; then fixed with hypo. or cyanide as usual. This is all the manipulation required for the most beautiful, clean, and splendid negatives. As to sensitiveness, the Newton plates require, in the gallery, less than half the time necessary for wet plates. Portraits by the Newton plates are taken in from five to ten seconds; while the wet process, same light and lenses, requires from twenty to forty seconds. For outdoor work, the Newton plates yield as good or better instantaneous pictures than wet plates.

The exact formula for the emulsion has not yet been made known by Mr. Newton, but will in due time be freely given to the public. It is sufficient for the present to say that the emulsion is prepared with an excess of free nitrate of silver, which is allowed to remain for a certain number of hours, when chlorides are added. The Scoville Manufacturing Company of this city supply the new emulsion, with practical directions for its use.

The second photo improvement relates to printing, and is that of Mr. William Willis, Jr., of Birmingham, England. The surface of the paper, sized with arrowroot, is first moistened for a moment with nitrate of silver solution (six grains to the

ounce) and dried. In this condition, the paper keeps for any length of time. The paper is further sensitized by coating with a solution of chloro-platinite of potassium and a solution of ferric oxalate. It is then exposed under the negative for only one sixth of the time required for a common silver print. The picture is then toned with gold, treated with hypo., washed, and finally placed in a weak solution of oxalic acid, again washed and dried. The permanency of these prints is remarkable. Mr. T. Rodger recently submitted specimens to the Edinburgh Photographic Society, which he said he had put to extreme tests. One of them, for example, had been subjected to sulphuretted hydrogen for twelve hours, and then to twelve additional hours in the acid solution employed to form the gas, all without change. We have lately had the pleasure of examining some of these platinum prints, brought to this country by the author, which in tone and color, were in every way equal to the best silver prints.

NEURALGIC STORM BELTS.

Dr. S. Weir Mitchell, a physician of Philadelphia, Pa., has recently conducted an important series of very interesting investigations with reference to the relations of bodily pain to the weather. It is an old popular idea that diseases and injuries of the bones, chronic rheumatisms, and ancient wounds produce a renewed pain on the approach of a storm; so much so, indeed, that persons thus afflicted frequently are able to predict impending changes of weather with remarkable accuracy. In the course of study of many of the curious symptoms belonging to the stumps of amputated limbs, Dr. Mitchell frequently encountered the above notion; and he became so impressed by the repeated testimony of patients, who stated that their comfort depended largely on the state of the weather, that he resolved to undertake careful research into the subject. He was fortunate enough to obtain the co-operation of Captain Catlin, U.S.A., who had lost a leg in action during the war, and had become a sufferer with neuralgia in the stump, the pain seemingly residing in portions of the absent foot. This officer kept records of his painful sensations, in connection with the weather reports as shown by the Signal Service, for three years; and he prepared elaborate maps and charts, showing just how certain attacks corresponded to certain periods of barometric depression and other meteorological phenomena. In brief, he conducted his self-examination with an accuracy and scientific thoroughness which cannot be too highly commended.

The result now adduced by Dr. Mitchell is that there is every reason to believe that the popular view which relates some pain fits to storms has a distinct foundation; but that, as the single element of mischief has not been detected, he is driven to believe that it is the combination of atmospheric conditions which starts the pain into being. The separate factors of storms, such as lessened pressure, rising temperature, greater humidity, and winds, appear as a rule to be incompetent, when acting singly, to give rise to attacks of pain. Either it is, as above stated, a combination which provokes the pain, or it may be some as yet unknown agency, acting alone. It was observed by Captain Catlin that his sensations of pain prevailed when the aurora was intense. Whether this was due to the magnetic or electric disturbance prevalent or to the succeeding storm, Dr. Mitchell thinks is questionable.

About the most striking conclusion reached is that relating to the neuralgic storm belt. Every storm, as it sweeps across the continent, consists of a vast rain area, at the center of which is a moving space of greatest barometric depression known as the storm center, along which the storm moves like a bead on a thread. The rain usually precedes this by 600 miles; but before and around the rain lies a belt, which may be called the neuralgic margin of the storm, and which precedes the rain by about 150 miles. This fact is very deceptive, because the sufferer may be on the far edge of the storm basin of barometric depression, and, seeing nothing of the rain, may yet have pain due to the storm. "It is somewhat interesting," adds Dr. Mitchell, "to figure one's self thus—a moving area of rain girdled by a neuralgic belt 150 miles wide, within which, as it sweeps along in advance of the storm, prevail, in the hurt and maimed limbs of men and in tender nerves and rheumatic joints, renewed torments called into existence by the stir and perturbation of the elements."

A NEW EXPLOSIVE COMPOUND FOR LARGE GUNS.

The dangerous element to a gun, from any explosion taking place within it, is the rate at which that explosion occurs. Stress due to a blow is very much more difficult to resist than strain gradually applied; and for this reason it is that the slow burning and comparatively weak gunpowder is retained when so many much more powerful explosives exist. No gun has yet been invented capable of withstanding the effects of explosion of gun cotton charges for any length of time, although abundant experiment has been made in this direction in the hope of substituting gun cotton for gunpowder. It is known that an immense advantage would be gained if the whole force of a nitroglycerin explosion could be concentrated on the base of a projectile; but the trouble is that no one has discovered how to harness nitroglycerin for artillery purposes; or in other words, no one has yet devised an apparatus whereby nearly the whole power of the explosion can be directed upon the ball, and merely a minimum left to act towards rending the gun asunder.

It follows from this that the theoretically most advantageous explosive for gunnery purposes is one which has an accelerating action, and that it must focus its power upon