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

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.

Remit by postal order. Address

MUNN & CO., 37 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, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$500 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.

Scientific American Export Edition.

The 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 30 cents. (27) 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. 37 l'ark Row. New York.

NEW YORK, SATURDAY, MARCH 19, 1881.

Contents.

(Illustrated articles a	ire n	arked with an asterisk.)
Air and water	176	Inventions, mechanical,
Albumen, bleaching	177	Inventions, miscellaneous
Alcohol, rectifying	177	Inventions, new
Alligator, white, the	184	Iron, to protect from rust (15)
Amœboid movements, illus. of	185	Lace machine, improved
·Animal reasoning	184	Lacquers for brass (31)
Artificial daylight	177	Lard cheese 1
Aspha't walks (24)	187	Lime, the excretion of
Barrel machinery*	175	Luminous paint (30) 1
Barometer, glycerine	178	Machanical inventions 1
Bath teb folding, new*		Metals, color relations of 1
Belt, Professor, reception of	182	Mines, electric lighting of
Blue, process paper for (17)	186	Nasal, pharyngeal catarrh 1
Boilers, whose explode	176	Oakland harbor Obelisk, the, presented to N Y.
Bronchial catarrh	185	Obelisk, the, presented to N Y
Canada, industrial condition of .		Opium, how produced in India
Catarrh.	185	Petroleum product, last year's 1
Cement for wooden cisterns (25).		Platinum works. Mr. Bishop's
Cheese, lard	1 (0	Railway station St. Goth. tunnel
Cheiromeles, the*.	183	Reasoning, animal
Caloride of lime, to make (22)		Reception of Professor Bell
		Rope clamp, improved*
Composition, new, another	177	Salmon, marking
Disease, new, a		Sanitary arrang, in houses
Disinfect, with sulphurous acid.	170	Sea sounding, instrument for
Eggs, to preserve (16)	193	Steel casting, crucib'e, great
Elisticity of wires	184	Storm warnings in court
Electrical exhibition, French		Swivel holder for fish hooks*
Electric lighting of mines		Telegraph, the, how kept in order
Fire escape, simple.	177	Telephone transmitter, new*
Fire extinguishers, filling for (29)		Telephonic electric condensers
Fish, remarkable, a	177	Tinning iron (18)
Fruit flavoring	179	Velvet, wool
Gas bags, to make (21)	186	Voyage long, in a small boat
Glass, to emboss (25)	187	Warnings, storm, in court
Glass, to repair (38	187	White alligator, the
Glue, thin and strong (32)	187	Wires, clasticity of
Hanover Technical Academy	187	Wool velvet
Horned screamer, the*		Workroom, a rich man's
Hudson river tunnel	182	Zodiacal light
Industrial condition of Canada	176	•
	_	

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 272.

For the Week ending March 19, 1881.

Price 10 cents. For sale by all newsdealers,

PAG
1. ENGINEERING AND MECHANICS.—Calvert Street Bridge, Balti-
more Full page illustration. Perspective elevations sections.
details
details
Improved Water Gauge for Boilers, 3 figures
Device for Cleaning Boiler Tubes 1 figure 432
A Newly Discovered Property of the Ellipse, and its Application
to the "Oval Chuck." By FRANK M. LEAVITT 2 figures 433
The Lighthouse of Ar-men. Finisterre, 4 figures. Elevation,
vertical section, plan. Elevation and plan of the rocks at Ar-men. 433
Failure of a Dock Wall. By Lieut. H. D. LAFFAN, R.E 433
Approximate Rules for the Penetration of Armor 483
Short Lessons to Shipbuilde s
Experiments on the Position of Screw Propellers. 3 figures. 433
United States Ocean Commerce in United States Built Ships.
National Convention Paper, by W. H. WEBB
Plain and Ornamental Borders for Coach Painting. By THEO.
CHILD. 14 figures
A Librarian's Notion of What a Library Building should be. W.
F. Poo'e's paper before the Convention of the American Library
Association 433 House Drainage, Sewerage, and Ventilation. Paper read by
Reginald Middleton before the Society of Civil and Mechanical
Engineers, London
Engineers, Dondon 453
II. TECHNOLOGYEvery Man his own Sensitive Plate Maker. By
J. A. FORREST. Gelutine Dry Plates -Substratum - The Emul-

4334

- V. CHEMISTRY.—Chemical Decomposition Incited by a Cold Fluid
 Stratum Floating on a Warm Liquid. By Dr. HENRY A. MOTT, Jr. 4338
 Upon the Production of Ozone by Heating Substances Containing Oxygen. By Dr. A. R. LEEDS
 Separation of Cobart and Nickel. By F. REICHEL. 4341
 Separation of Cobart and Nickel. By F. REICHEL. 4341
- VII. ART.—Suggestions in Decorative Art. Panel from the Communion Table in the Cathedral of Verdun. Designed by A. G. Moreau, Paris.

THE ZODIACAL LIGHT,

On almost any clear moonless night now this phenomenon may be noticed in the western sky. In the early part of such an evening, after the twilight has disappeared, a trian- ance. gle of faint light will be seen extending up into the sky. Its base will be found about the place on the horizon where the sun disappeared, and may be of considerable, though of part of the year. A glance at any celestial globe, or at a require a number of volumes. terrestial globe having the ecliptic marked upon it, will make this perfectly clear.

ern latitude, then turned over toward the west, it will be and often do become the vehicles of deadly poisons, which noticed at about eight o'clock that the ecliptic is nearly per- in densely populated countries and towns are liable to conpendicular to the horizon, and passes close by the zenith, taminate them. It is of essential importance that supplies the point in the sky directly overhead. As the zodiacal light of each needed for the support of animal life should be pure. always lies along the ecliptic, and is close to the sun, it is Air and water are the great natural distributers of heat clear that about the 1st of March affords the most favorable and cold. The climates of different parts of the world are evenings for its observation; it then extends farthest up into very materially affected by the hot or cold currents of air the sky. In the latitude of the north United States its path which flow over them, and by the analogous currents of does not run directly toward the zenith, for the ecliptic never water established by the action of heat in the great seas. runs through our zenith, but to a point a little way south of Proximity to large bodies of water also has a very importthat. In fact it extends up toward the noonday position of ant effect upon climate. Water slowly absorbs the sumthe sun in the longest summer days. The globe will also mer heat in very large quantity, and slowly gives it off show that at an hour or more before sunrise the ecliptic is again to the colder air of winter, thus tempering what would nearly perpendicular to the horizon, and hence rises highest otherwise be cold and freezing winds, and retarding frost. in October. The zodiacal light is thus seen best in the early. morning in October. Except at these seasons it stretches chanical energy. The currents of rivers represent a portion along the sky so near to the horizon that it is generally un- of the mechanical equivalent of solar heat expended in raisnoticed. The present is, then, the most favorable time of ing the masses of water that flow through their channels to year for evening observation of this curious phenomenon, the clouds. The winds that propel our ships and wind and for several weeks any one may find it. It will not do to motors are the product of solar energy also. The chief and expect too close a resemblance to the cuts of the light usu- most economical means by which the heat generated in the ally given in our text books. They make it more distinct combustion of fuel can be converted into mechanical energy and with sharper outlines than it will be found to have in for the propulsion of machinery is water, which this heat the sky, as well as too narrow for its ordinary shape. The converts into steam. cause of the zodiacal light is still uncertain. From its nearmust be sought for about the sun. Kepler ascribed it to an the sun's gravity, and that it could not be an atmosphere be- perish. longing to and revolving with the sun in any such sense as the nature of the reflecting substance. It may be a cloud of be immovably imprisoned. gaseous matter, or possibly of small particles of solid matter, surrounding the sun and extending out upon all sides portion of our land perform a similar service for the vegetatoward the earth's orbit. More probably it is due to immense ble life which lies dormant below. Without this protection swarms of meteoroids surrounding the sun, and thus reflect- the ground would be too deeply frozen, the frost would be G. M. P. ing its light to the eye.

WHOSE BOILERS EXPLODE.

The records kept by the Hartford Steam Boiler Inspection tudes where they now abound. and Insurance Company show that 170 steam boilers exploded tember and November, 16 each; the other months ranged from 10 to 14, the lowest number being in June.

The classified list shows the largest number of explosions in any class to have been 47, in sawing, planing, and woodyachts, steam barges, dredges, and dry docks, 15; portable itself. engines, hoisters, thrashers, pile-drivers, and cotton gins, 13; Thus is illustrated the wonderful character of these comhouses, soap, and chemical works, 10.

It would be an interesting thing to have a statement of relative frequency of explosion—the number, that is, to each thousand boilers in use in each given class of steam-using esta blish ments.

STORM WARNINGS IN COURT.

Rockaway, built at Norfolk, Va., was taken by the steamship Wyanoke, of the Old Dominion Line, to be towed to ernment Storm Signals, but they were disregarded by him. tions of the new prosperity: Subsequently the storm became violent, and the Rockaway

the protection of the property in his care. The case was recently decided, the jury returning a verdict for the plaintiff, giving him \$35,018.37, with five per cent. allow-

AIR AND WATER.

The two substances everywhere met with on the surface varying and somewhat indefinite width. It will taper up- of this globe which receive the least popular attention are ward and gradually fade out about half way from the hori- air and water. The latter especially is one of the most rezon to the zenith, although it has been observed extending markable substances in nature, and exceeds in its pervasivethrough ninety degrees, and even entirely across the sky. ness even the air. Go where we will, on the most arid Its edges are so indefinite that no two observers will agree as desert, the mountain top, the frozen pole, in the deepest to just what its limits are. It is not generally noticed, be-cavern, we meet with water in some or all of its forms. The cause it looks so much like an extension of twilight that it is coldest, hottest, or driest air found in nature contains aquemistaken for that. But, as has been said, it is to be seen ous vapor. Water forms a large portion of many minerals, when the twilight has entirely disappeared, and its shape is in which by the giant power of chemical affinity it is diso different that any one can distinguish it. It is found to rectly combined or is locked up as water of crystallization. lie along the ecliptic, that is, the sun's path in the heavens. To adequately discuss all the natural phenomena in which The ecliptic is more nearly perpendicular to the horizon dur- some form of water is a factor, would require a volume; to ing the evening now than during the evenings of any other enumerate and describe all its industrial applications would

Both air and water are essential to the existence of all known life. Our bodily health can only be supported by If such a globe be set for the 1st of March and for a north- our taking quantities of both at short intervals. Both may

Air and water are the great natural distributers of me-

The envelope of aqueous vapor which surrounds the ness to the sun, and its position along the ecliptic, its origin, globe, and forms a notable part of its atmosphere, is, as has been well shown by Tyndall, the great conservator of terresatmosphere about the sun, and this view was generally held trial heat. Should this aqueous envelope be removed by until Laplace showed that its observed limits were far beyond any cause the heat of the earth's surface would so rapidly the point where centrifugal force would balance the force of radiate into space that every living thing would shortly

The ice cover which forms upon the surfaces of lakes and our atmosphere belongs to the earth. Prof. Wright, of Yale rivers protects the life which exists in such waters. Were College, has shown by means of the spectroscope that the it not for this provision of nature these water deposits would zodiacal light is reflected sunlight. But this does not determine; become solid masses, in which all their teeming life would

> The snowblankets which have spread this year over a large too late in leaving the earth in the spring, the growing season would be shortened, and many of the plants that now thrive in the temperate zones would cease to exist in lati-

Air and water vapor are the great diffusers of light. Were in the United States last year, killing 259 persons and wound it not for our atmosphere no solar light could penetrate our ing 555. The greatest number of explosions in any month houses where the sun's rays do not directly enter, except such was 25, in December. The number for January is 19, Sep- as might be reflected from solid objects. Everything not directly illuminated by the sun would lie in deep shadow. In the mid-day many of our apartments would require artificial illumination. Out of the direct sunshine only the lowest forms of life could exist. But the enormous diffusing, working mills. The other principal classes were in order: transmitting, and reflecting power of our atmosphere com-Paper, flouring, pulp and grist mills, and elevators, 19; rail- pensates almost wholly for disadvantages of position, causroad locomotives and fire engines, 18; steamboats, tugboats, ing light to penetrate almost as universally as the air

iron works, rolling mills, furnaces, foundries, machine and mon substances—air and water—so important to all animated boiler shops, 13; distilleries, breweries, malt and sugar existence, yet so heedlessly regarded by the mass of mankind.

THE INDUSTRIAL CONDITION OF CANADA.

A couple of years ago our Canadian neighbors, tired of industrial stagnation, adopted a protective tariff in the hope of developing home industries. A return to a free trade policy is strenuously insisted upon by many Canadians, On the night of March 24, 1877, the hull of the steamboat whose idea of national economy never rises above the sophistry of "buying in the cheapest market."

In an argument for the policy now under trial the Industhis city. As the vessels passed Fortress Monroe the atten- trial World of Montreal describes a very hopeful state of tion of the captain of the Wyanoke was called to the Gov-things as its first fruits, and points out the obvious condi-

"Suppose, for instance, a factory is opened in Montreal, giving employment to 1,000 hands, what does this mean? The owner of the Rockaway brought suit against the Old One thousand factory employes will represent a population Dominion Steamship Company to recover damages to the of at least 2,500. What would the closing of this factory the captain of the Wyanoke, in disregarding the storm loss of 1,000 to 2,500? Much more. These artisans require 4388 signals, failed to exercise due diligence and precaution for boot, shoes, hats, caps, meat, bread, roots, vegetables, medi-