## Stitutific © Mmpricall.

HSTABLISHED 1845.
MUNN \& CO., Editors and Proprietors.

## pUBLISEED WEERLY AT <br> NO. 3 ' 7 PARK ROW, NEW YORK.

O. ग. MUNN. $\quad$ A. E. BEACB.

TERMS FOR THE SCIENTIFIC AMERICAN One conv. one year wostaze included....
One cony, six months, postage included
Clubs.-One extra copy of The Sciestricic American will be supplied
gratis for every crut of tive subscribers at $\$ 3.20$ each additional copies at gratis for every ciub of tive subseribers Remit portionate rate

The Scientific MUNN \& CO., 37 Park Ror, Is a distinct paper from the Scter cricic American. The Supliement ith Scientific American. Terms of subscription for Supplemian 500 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by Cows dealers throughout the country.


Scientific American Export Edition


NEW YORK, SATURDAY, MARCH 19, 1881


TABLE OF CONTENTS OF the scientific american supplement No. 272.

## For the ween ending March 19, 1881

 Price 10 cents. For sale by all hewsidealers










v. PHrsics - Action of an Internittent Beam of H adiant Heat




VI. NATURAL HISTORY-On The Graing of Silica and Microcococe


## THE ZODIACAL LIGHT

On almost any clear moonless night now this phenomeno may be noticed in the western sky. In the early part of
such an evening, after the twilight has disappeared, a triangle of faint light will bhe twiggit base will be found about the place on the horizon where the sun disappeared, and may be of considerable, though of varying and somewhat indefinite width. It will taper up. ward and gradually fade out about half way from the hori zon to the zenith, although it has been observed extending through ninety degrees, and even entirely across the sky. Its edges are so indefinite that no two observers will agree as to just what its limits are. It is not generally noticed, be cause it looks so much like an extension of twilight that it is mistaken for that. But, as has been said, it is to be see when the twilight has entirely disappeared, and its shape is so different that any one can distinguish it. It is found to lie along the ecliptic, that is, the sun's path in the heavens. The ecliptic is more nearly perpendicular to the horizon during the evening now than during the evenings of any other part of the year. A glance at any celestial globe, or at a terrestial globe having the ecliptic marked upon it, will make this perfectly clear.
If such a globe be set for the 1st of Marchand for a north ern latitude, then turned over toward the west, it will be noticed at about cight o'clock that the ecliptic is nearly per pendicular to the horizon, and passes close by the zenith, the poiut in the sky directly overhead. As the zodiacal light always lies along the ecliptic, and is close to the sun, it is clear that about the 1st of March affords the most favorable evenings for its observation; it then extends farthest up into the sky. In the latitude of the north United States its path does iot run directly toward the zenith, for the ecliptic never runs through our zenith, but to a point a little way south of that. In fact it extends up toward the noonday position of the sun in the longest summer days. The globe will also show that at an bour or more before sunrise the ecliptic is nearly perpendicular to the horizon, and bence rises highest in October. The zodiacal light is thus seen best in the early morning in October. Except at these seasons it stretches along the sky so near to the borizon that it is generally unnoticed. The present is, then, the most favorable time of year for evening observation of this curious phenomenon, and for several weeks any one may find it. It will not do to expect too close a resemblance to the cuts of the light usually given in our text books. They make it more distinct and with sharper outlines than it $\kappa$ ill be found to bave in the sky, as well as too narrow for its ordinary shape. The cause of the zodiacal light is still unccrtain. From its near ness to the sun, and its position along the ecliptic, its origin must be sought for about the sun. Kepler ascribed it to an atmosphere about the sun, and this view was generally held until Laplaceshowed that its observed limits were farbeyond the point where centrifugal force would balance the force of the sun's gravity, and that it could not be an atmosphere belonging to and revolving with the sun in any such sense as our atmosphere belongs to the earth. Prof. Wright, of $\mathrm{Ya}_{\mathrm{a}}$ College, has shown by means of the spectroscope that the zodiacallight is reflecied sunlight. But this does not determine the nature of the refiecting substance. It may be a cloud of ter, surrounding the sun and extending out upon all sides to ward the earth's orbit. More probably it is due toimmense swarms of meteoroids surrounding the sun, and thus reflect
ing its light to the eye. G. M. P.

## WHOSE BOILERS EXPLODE.

The records kept by the Hartford Steam Boiler Inspection and Insurance Company show that 170 steam boilers exploded in the United States last year, killing 259 persons and wound ing 555. The greatest number of explosions in any month ing 5i5. The greatest number of explosions in any mone
was 25 , in December. The number for January is 19, Sep was 25, in December. The number for January is 19 , Sep-
tember and November, 16 each; the other months ranged tember and November, 16 each; the other mon
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 woodworking mills. The other principal classes were in order Paper, flouring, pulp and grist mills, and elevators, 19; rail road locomotives and fire engines, 18; steamboats, tugboats, yachts, steam barges, dredges, and dry docks, 15; portable engincs, hoisters, thrashers, pile-drivers, and cotton gins. 13; iron works, rolling mills, furnaces, foundries, machine and boiler shops, 13; distilleries, breweries, malt and sugar bouses, soap, and chemical works, 10
It would be an interesting thing to have a statement of 341 relative frequency of explosinn-the number, that is. to each thousand boilers in use in each given class of steam-using estahlishments.

STORM WARNINGS IN COURT.
On the night of March 24, 1877, the hull of the steamboat Rockaway, built at Norfolk, Va., was taken by the steamship Wyanoke, of the Old Dominion Line, 10 be towed to this city. As the vessels passed Fortress Monroe the atten tion of the captain of the Wyanoke was called to the Gov ernment Storm Signals, hut they were disregarded by him. Subsequently the storm became violent, and the Rockaway was wrecked.
The owner of the Rockaway brought suit against the Old Dominion Steamship Company to recover damages to the the captain of the Wranoke, in disregarding the storm signals, failed to exercise due dilligence and precaution for
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 ance.

## air and water

The two substances every where met with on the surface of this globe which receive the least popular attention are air and water. The latter especially is one of the most re markable substances in nature, and exceeds in its pervasive ness even ihe air. Go where we will, on the most arid desert, the mountain top, the frozen pole, in the deepest cavern, we meet with water in some or all of its forms. The coldest, hottest, or driest air found in nature contains aque ous vapor. Water forms a large portion of many minerals, in which by the giant power of chemical atfinity it is di rectly combined or is locked up as water of crystallization. To adequately discuss all the natural phenomena in which some form of water is a factor, would require a volume; to enumerate and describe all its industrial applications would equire a number of volumes.
Both air and water are essential to the existence of all known life. Our bodily health can only be supported by our taking quantities of both at short intervals. Both may and often do become the vehicles of deadly poisons, whic in densely populated countries and towns are liable to contaminate them. It is of essential importance that supplies of each needed for the support of animal life should be pure Air and water are the great nalural distributers of heat and cold. The climates of different parts of the world are very materially affected by the hot or cold currents of ai which flow over them, and by the analogous currents of water established by the action of heat in the great seas. Proximity to large bodics of water also has a very import ant effect upon climate. Water slowly absorbs the sum mer heat in very large quantity, and slowly gives it off again to the colder air of winter, thus tempering what would berwise be cold and freezing winds, and rctarding frost.
Air and water are the great natural distributers of me chanical energy. The currents of rivers represent a portion of the mechanical equivalent of solar heat expended in rais ing the masses of water that flow through their channels to the clouds. The winds that projel our ships and wind motorsare the product of solar energy also. The chief and most economical means by which the heat generated in the combustion of fuel can be converted into mechanical energy for the propulsion of machinery is water, which this heat converts into steam.
The envelope of aqueous vapor which surrounds the globe, and forms a notable part of its atmosphere, is, as las been well shown by Tyndall, the great conservator of terres. trial heat. Should this aqueous envelope be removed by any cause the heat of the earth's surface would so rapidly radiate into space that every living thing would shortly perish.
The ice cover which forms upon the surfaces of lakes and

 be immovally imprisoned
The snowblankets which have spread this year over a large portion of ourland perform a similar service for the vegetable life which lies dormant below. Without this protection the ground would be too decply frozen, the frost would be 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 latiudes where they now abound.
Air and water vapor are the great diffusers of light. Were it not for our atmosphere no solar light could penetrate our houses where the sun's rays do not directly enter, except such as might be reflected from solid objects. Everything not directly illuminated by the sun would lie in deep shadow. In the midday many of our apartments would require artificial illumination. Out of the direct sunshine only the low est forms of life could exist. But the enormous diffusing transmitting, and reflecting power of our atmosphere com pensates almost wholly for disadvantages of position, caus. ing light to penetrate almost as universally as the air itself.
Thus is illustrated the wonderful claracter of these common substances-air and water-so important to all animaled existence, yet so heedlessly regarded by the mass of man. kind.

## 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 bome industries. A return to a free trade policy is strenuously insisted upon by many Canadians, 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 Indus. trial World of Montreal describes a very hopeful state of things as its first fruits, and points out the obvious conditions of the new prosperity

Suppose, for instance, a factory is opened in Montreal, giving employment to 1,000 hands. what does this mean One thousand factory employes will represent a population of at least 2,500 . What would the closing of this factory and consequent expatriation of these craftsmen mean? A loss of 1,000 to 2,500? Much more. These artisans require boot, shoes, hats, caps, meat, bread, roots, vegetables, medi-
cine, clothing, houses, wood, etc., almost ad infinitum, and likewise each of the new or additional industries which they inaugurate or add to in all its various forms, require the same things. So that each thousand artisans probablyadds, in one way or other, 5,000 additional to the population. Have our frec trade fricnds ever considered this? What emptied one-fifth of the houses of Montreal under the late regime? The closing of the factories. What stunted the growth of the city during.that dark era? The impediments which the tariff raised to the establishment of new industries and the development of diversified labor. All the artisans employed in the factories of the metropolis wanted homes It required carpenters, joiners, bricklayers, painters, plasterers, roofers, glaziers, workingmen of all kinds to erect these houses. It required rast quantities of agricultural produce to fill the stomachs of the various craftsmen which the tariff furnished with a purchasing power. And although to-day the same clouds float over us, the same sun, moon, and stars light the heavens by day and night, in the language of Webster, How altered! and how clanged! Of 2,000 notes falling due on the 3d of February in the Bank of Montreal, not one was prolested!! Among the thousands of vacant houses in Montreal in '78, not an empty place is to be found, and the demand is for hundreds more. The market is flooded with money for investment. Canada fours are worth more than Canada sixes were formerly. Our alms houses, except for the old and infirm, are empty, and the soup kitchen is now a matter of history. The railways are unable to carry the freight offered to them, and the demand for increased accommodation is met by the employment of thousands of able hands, working night and day to meet the public wants! Never was there an era promising greater prosperity for Canada. Bank stocks have appreciated $371 / 2$ per cent, and all securities have become correspondingly improved in value, and the prospect of a $£ 1,000,000$ surplus for the financial year ending July 1, stares us in the face to terrify usinto a free trade policy! If it is a bad policy to swap horses while crossing the stream, we think it would be rather imprudent to risk a change from prosperity, under protection, to one of promised increased (?) aggrandizemen under free trade.

## ARTIFICIAL DAYLIGHT

The lighting of large interiors from without-that is, by surrounding the space to be irluminated with powerful lamps, so placed as to fill the air with diffused light-is cer tainly a bold, though not entirely a novel, proposition; yet, either to attract attention or to establish an important economic principle, the Northern Electric Light Compaus is begging Congress to allow them to light in that way the Capitol at Washington. At first they asked Congress to appropriate money enough to defray the actual cost of illuminating the Capitol and the grounds about it to the brilliancy of broad day, thus making interior lamps un necessary. But no disposition being slown by Congress to encourage the experiment, the friends of the project subsequently offered to assume the risk of failure, and to furnish the means for making such a crucial test of "artificial daylight," on condition that the government would agree to accept the innovation in case it succeeded, and the saving in the cost of lighting the Capitol slould prove in three years equal to the cost of the system. This proposition appears to have met with no greater favor than the first whether from suspicion as to its purpose or feasibility, or because the expiring Congress had larger and more pressing interests to consider, does not appear.

The pian proposed contemplated a crown of electric lamps, 150 in number, surrounding the dome of the Capitol, and so arranged as to shine into the skylights in the roofs of the wings of the building.
In addition, at various points about the Capitol grounds, it was proposed to erect six iron towers, to be surmounted by circular conical lanterns, 11 feet in diameter, and from 125 to 20 ) feet above the ground, or 50 feet higher than the roofs of the wings of the Capitol. Each lantern was to contain 50 electric lamps. The 450 lamps upon the dome and in the tower lanterns were designed to be about 6,000 candle power each, aggregating something like forty times the light power now employed in and about the Capitol, or about that of 200,000 average gasburners. This light, it is estimated, would not only illuminate the interior of the building as well as daylight, but would furnish a surplus sufficient to remove the need of street lamps any where in the city.

To generate the electric current there would have to be supplied not less than three dozen large dynamo-electric machines, capable of absorbing the power of four steam engines of 300 horse power each. The cost of the system was estimated at $\$ 350,00$ ), distributed as follows:

Four hundred and fifty 6,000 candle power electric lam
Thirt y-six large dynamo-electric machines, at $\$ 3,600$.
requisite fixtures and shafting
Houses for boilers and machinery
x iron towers-two 200 feet high, two 150 feet high, two 125 feet
high, including lanterns, refectors. elevators, and founda tions....
ting up
Setling up machinery and apparatas, including cost of subter
ranean wires Land.
ranean wires
and.........
Total
The estimated running expenses of the system, $\$ 350,000$
repairs, is $\$ 60,000$ a year-the present means of illuminating the Capitol costing annually upwards of $\$ 110,000$, the city paying $\$ 60,000$ more for street lamps. The aggregate illumination promised by the new system is twenty limes that of all the outdoor lamps in Washington and all the lamps in the Capitol building combined: or a light equiva lent to bright moonlight throughout the city, and diffused daylight in and about the Capitol.
Perhaps the incoming Congress will have time to investi

## gate the project, which is, at all events, a "brilliant'" one.

## New Instrument for Sea Sounding

Mr. Lucas, engineer to the Telegraph Construction and Maintenance Company, London, has invented an instrument for sea sounding which he styles a "nipper-lead." The ol plan of ascertaining the nature of the sea hottom, by bring. ing up a specimen of it in a tube, let into the bottom of the sinker and armed with tallow, is open to several objections. For instance, the specimen is apt to get washed out in rising to the surface, and when it is safely brought on board it is usually so smeared with tallow as to be objectionable. The ipper-lead of Mr. Lucas, on the other hand, retains what it atches and rendersit up in a pure state well fitted for preser ation. The bottom of the lead or sinker in question is pro vided with two hollow claws or spoons, not unlike the mandibles of a crab. These are hinged to the sinker, and pen out against the resistance of a stout spiral spring which is contained in the body of the sinker. When fully opened out they are kept apart by a locking device, consisting of two crossbars which meet end to end and fit iuto each other The points of the open claws, however, in striking upon the bottom, spring this lock, and the claws snap together with reat force, nipping up a specimen of the bottom at the same time, and from their hollow shape this specimen is re ained. So effective is the nipper-lead that the claws will ip a sheet of paper off a table, and they have been found t aise a specimen of the bottom from 2,000 fathoms.

## A Rich Man's Work Room

The owuer of the great Cornwall iron estate in Pennsylvania, Mr. Robert Coleman, has a fine mechanical taste and pays much attention to mechanics and engineering. To facilitate his investigations he has constructed a circular railroad with a double line of steel tracks, inclosed in a large building. The length of the track is about 150 feet, with two sidings. Patent safety switches, electric crossing signals, afety frogs, and the latest methods of fastening rails ar emploved. The turntables of the miniature round hous operate automatically. The three small locomotives comprise every piece of mechanism, every rod, bolt, screw, ever, spring, tire, cock, pipe, and pump of the largest ma chines. The boiler-jackets, rods, and drivers are nickel plated, and some of the bright work is silver-plated. The cabs are of solid walnut, and the boilers proper and the fire boxes are of wrought steel. The tenders are of copper, and their water supply is taken by scoops from vats on the road ay while the locomotives are in motion.
The locomotives are about four feet in length, including the tender, and are models of beauty. They are of English design, so far as high driving wheels are concerned, otherwise they are advanced American mechanical ideas and hav many original appliances of Mr. Coleman's invention.
The locomotives are fired up and set in motion. Around the tracks they go, while the millionaire owner watches the movements of the miniature machinery. Hours are thus pa: sed, all sorts of experiments are tried, high speed and
low speed are compared to determine the comparative effects of friction, and other questions of railway economy.

## A Remarkable Fish.

There was lately on exhibition in Boston a fish caught bout twelve miles from the Isles of Shoals by Wallace Wright, of the fishing schooner Jennie P. Phillips, from wampscott. At the time of its capture it was 15 feet long and weighed 2,430 pounds. In its stomach were found a codfish weighing 50 pounds, two smaller cods, and two coots. It had a large mouth, containing seven rows of sharp
eeth, and in general appearance was somewhat like a shark eeth, and in general appearance was somewhat like a shark, ut what is most singular is the fact of its being uncommonly mouth, but gills, nostrils, and blow holes. While on exhibition at Lynn the fish was examined by several scientific gentlemen, but no one has been able to classify it.

## Improved Lace Machine.

A machine for making laces hitherto produced only by hand work is reported in France. Even old styles of laces, the art of making which has been lost, can readily be repro duced. The machine employs from 1,800 to 2,000 spindles and from 200 to 300 pins. The Moniteur des Fils et Tissu speaks in high terms of the machine aud its products, which are said to be fully equal to the best himd-made laces.

## SANITARY ARRANGEMENTS IN HOUSES

The Society of Arts, London, have just announced that they will award three medals for plans showing the best sanitary arrangements in houses built in the metropolis, such plans to be exhibited in the society's rooms, Adelphi, in June, 1881, and to be sent in on or before May 12, 1881: Tine conditions of the competition are as follows:

1. One silver medal will be awarded for the best sanitary arrangements carried out and in satisfactory working in a house let out in tenements to artisans for which a weekly rental is paid.
2. Ove silver medal for the best sanitary arrangements in actual satisfactory working in a house of the yearly rental of from $£ 40$ or less, to about $£ 100$ in value.
3. One silver medal for the best sanitary arrangements in actual salisfactory working in a house of the yearly rental value of $£ 200$ and upward to \%ny amount.
4. The houses must be open to the inspection of judges, who, in considering their award, will be guided by the sug. gestions of plans for main sewerage, drainage, and water supply, made under the Public Health Act, 1875. The houses must have been in actual occupation within the last three months, and a certificate must be given by the occu piers, on a printed form, stating the satisfactory working of all the sanitary arrangements, such form to be obtained at the Society of Arts.
5. The houses may be old, fitted with modern sanitary arrangements, or may be new. They must be within the metropolitan area of the Board of Works.
6. The sanitary arrangements must include the conditions for good water supply, drainage, warming, and ventilation of the house, and precautions taken against frost.
7. The medals may be awarded to the occupiers of the houses, or the lessees, or the owners.
8. The plans must consist of a ground planand sections, to the scale of not less than 1 inch to 5 feet; details not less than 1 inch to the foot. The plans may be accompanied by specifications.
9. The names of the architects, surveyors, or sanitary en gineers who directed the sanitary arrangements should be given, and certificates will be awarded to those whose plans obtain the medals

## French Electrical Exhibition.

The works for the Paris Exhibition of Electricity will soon begin. A viaduct is to be built for the English electrical railway by Siemens, which will convey visitors from the Place de la Concorde to the Palais de l'Industrie. The in ternal a ruarements will only be made at the end of the Art Exhibition, which takes place from May to July. The French exhibitors of the electric light havecome to an agree ment in order to combine for the illumination of the nave and other parts. They are trying to obtain from the city an ndemnity for their working expeuses.

## Simple Fire Escape.

The netting which trapeze performers use to break their fall, in case of accident, the Fireman's Journal suggests, might furnish a valuable hint to Fire Department officials. Such a net could easily be carried in a small compass at tached to the hook and ladder truck, and could be readily and securely fastened by ropes to lamp posts, telegraph poles, wning posts or the like, in front of the burning house, or in case of need be upheld by dozens of sturdy and willing arns. It would, no doubt, help to save many lives of per ons compelled to jump from upper windows. Such a device has been tried in Germany with good results.

## Marking Salmon

The Fish Commissioners of Maine have adopted the plan of marking salmon to obtain data with regard to the develop ment and migrations of these fish. Several hundred salmon ately set free in the Penobscot River have been labeled with light metal tags, the number on each being recorded. The Commissioners ask that whoever catches a labeled almon in any waters of the State will forward to them the fish, for which they will pay an extra price, or else forward the label and whatever they know about the fish that woreit.

## Rectifying Alcohol.

If a quantity of 40 to 50 per cent alcohol is placed into retort and a vacuum is created in this retort by means of an air pump, and the retert is placed into or in connection with the cooler of an ice machine, the alcohol will be evaporated. As the evaporation of the alcohol causes the tem perature of the retort to drop below the surrounding temperature, the warmth of water at an ordinary temperature will be sufficient to evaporate the alcohol, and the same can be rectified without the use of fuel. $-R$. Pictet, in Revre Univ. de la Brass et Dist.
Bleaching Albcmen by mans up Electric Light. The albumen, from which the blood corpuscles have been en tirely removed, is subjected to the action of an electric light, the rays of which are properly collected by means of lenses, etc., and will be bleached within twenty-four hours. The albumen may be in a dry or fluid state.-L. Manet (Monit. prod. Chim.).

An examination has taken place at Brussels of the railway employés, in order to test their eyes. More than onetwentieth of them have been found defective. and consequently will be discharged as being unable to fulfill their functions with a sufficient security for travelers.

