

Scientific American.

ESTABLISHED 1846.

MUNN & CO., Editors and Proprietors.

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

O. D. MUNN. A. E. BEACH.

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

VOLUME XXXV., No. 3. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JULY 15, 1876.

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Vol. II., No. 29.

For the Week ending July 15, 1876.

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The Scientific American Supplement

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LIFE WITHOUT LIGHT.

An interesting discussion has recently taken place in the French Academy of Sciences, on the question of the influence of solar radiation, and of the green matter in the formation of the immediate principles of plant organisms.

M. Boussingault considers this influence to be indispensable, and that, if the solar radiation should disappear, life would be impossible. M. Pasteur on the other hand thinks that life might still continue in certain inferior plants and occasion the most complete organic growths. He cites as an example the life of the mycoderma aceti, which may take place in darkness on a liquid composed of alcohol, acetic acid, and mineral phosphates, the latter including phosphate of ammonia.

The mycoderma aceti to which M. Pasteur alludes is a remarkably curious organism, which serves as a medium between the oxygen of the air and a combustible body or fermentable matter, to produce combustion or oxidation. Fermentation of this kind has thus a special character, and differs from that set up by yeast or in other ways. The mycoderma aceti appears as continuous membrane, either wrinkled or smooth, upon the surface of liquids while the same are undergoing acetic fermentation, and is generally formed of very minute elongated cells whose diameter varies from 0.000059 to 0.000118 inch. These cells are united in chains or in the form of curved rods. Multiplication seems to be effected by the transverse division of the fully developed cells, which division is preceded by a median constriction. If we allow this cryptogam to develop itself on the surface of any organic liquid containing phosphates and nitrogenous organic matter, until the whole surface of the liquid is covered: then if we remove the liquid without disturbing the membrane, and substitute an equal volume of water containing 10 per cent alcohol, the plant immediately sets up a reaction between the alcohol and the oxygen of the air. After a certain time the action, impeded by the great acidity of the liquid, becomes slower; but we can restore it to activity by substituting alcoholized water again. So that, as long as the mycoderma is supplied with suitable nutrition, it will go on and burn the alcohol; but if on the contrary we deprive it of nourishment, or in any wise diminish its vital activity, then its oxidizing action will not go so far, and the alcohol may change into acetic acid. This is the substance of one of M. Pasteur's most brilliant investigations, among the practical results of which is a new commercial method for the acetification of fermented liquids. The process consists in sowing the mycoderma aceti on the surface of liquor containing 2 per cent of alcohol, 1 per cent of vinegar, and traces of alkaline and earthy phosphates. When the surface is covered with membrane, the alcohol begins to acidify. This action being fully set up, some alcohol, wine, or beer mixed with alcohol is added every day to the liquid in small quantities; the acetification is then allowed to terminate, and the vinegar is drawn off. The membrane is collected, washed, and employed for a new operation.

M. Boussingault's reply to the suggestion of the mycoderma by M. Pasteur is that it is true that some parasites attain a complete development in an artificial medium containing nothing but definite and crystallized chemical compounds. Still there is a great difference between this development and that of chlorophyll in plants. The latter take all their elements from the exterior world, carbon from the atmosphere, hydrogen and oxygen from water. The parasites, even those mentioned by M. Pasteur, take carbon in substances which, although of definite chemical construction, are derived from vegetable organisms. Alcohol and acetic acid have their origin in sugar, which cannot be formed save under the influence of solar radiation. The existence therefore of parasites in an obscure place, where their cellulose form immediate principles, similar to those produced in bright daylight by plants of green protoplasm, is far from being an exception, as has been affirmed, but is rather a confirmation of the necessary relation of light and vegetation. Hence M. Boussingault adheres to his opinion that, if the sun's light were quenched, not only chlorophyll plants, but also those deprived of chlorophyll, would disappear from the earth.

M. Pasteur's position appears, however, to be unassailable, as might well be expected from his immense experience and wide investigations touching the subject under discussion. He simply points to the fact that, by known methods of synthesis, chemists starting with carbon and watery vapor can produce alcohol, acetic acid, and many other substances capable of serving as carbonated aliment of inferior plants deprived of light. Moreover it may be conceived that, under the influence of the same, all the carbon existing at the surface of the earth or in the interior might pass into complex organic matters, and that ultimately it would return to the atmosphere in the form of carbonic acid through the actions of oxidation and fermentation. It would be only when this termination was reached that all manifestation of life would be impossible without the aid of solar light.

M. Pasteur's experimental determination that oxygen and light are not essentials of life, and his having caused organisms to exist in an atmosphere of carbonic acid and in absolute darkness, are among the greatest triumphs of modern chemistry.

THE ORACLES OF ANCIENT GREECE.

As the classical authors inform us, there were in ancient Greece, in different localities, so called sibyls, a kind of fortune-tellers, clairvoyants, or spiritual mediums, but of a social standing much higher than that of their successors at the present day, as they were not only recognized but maintained by a wealthy and influential priesthood, to whom the presents received from the faithful believers were a source of

enormous revenue. In our present state of society, we can scarcely form an idea of the power and influence of the priests as a separate class of society, monopolizing as they did all the profits derived from the superstitious, who wished to atone for their sins, to obtain knowledge not only of secret events, but also of the future, and to get advice as to their action in cases of difficulty, even to be cured of various diseases; and thus the priests monopolized, for many centuries, the functions of many professions, even that of the physicians, which Hippocrates at last succeeded in rescuing from the power of the priesthood.

These sibyls, of which the two prominent ones were the Cumæan and the Delphian, resided in gorgeous temples erected over caves, from which vapors arose which had an exhilarating and anæsthetic influence, similar to that of nitrous oxide or laughing gas, on those inhaling them. The author of a well known book, entitled "Art Magic," who for some time lived at the locality where the Cumæan sibyl once resided, states that it is one of the wildest, grandest, and most awe-inspiring gorges of the mountains around Lake Avernus, which itself is the inundated crater of an extinct but once mighty volcano; while the whole region around, now fertilized by the waters of the lake, bears the marks of the ravages of fire, presenting a most gloomy appearance. The clefts in the savage rocks abound with caverns, exhaling mephitic vapors and bituminous odors. The scattered inhabitants of the surrounding district once believed that the largest grotto was the entrance to the lower world, and that the hammers of the Titans, working in the mighty laboratories of the Plutonic realms, might be heard reverberating through the sullen air. The dark waters of Lake Avernus were supposed to communicate directly with the silent flow of the river of death, the Lethean stream, made dreadful by the apparitions of condemned spirits, who floated from the shores of the lake to the realms of eternal night. In this grotto resided the famous Cumæan sibyl; and from the exhalations, which were more or less poisonous to birds and other small animals which came near, the weird woman appears to have derived that fierce ecstasy in which she wrote and raved about the destiny of nations, the fate of armies, the downfall of kingdoms, and the decay of dynasties. Even monarchs and statesmen often acted according to her pretended revelations, as it was supposed that the purposes of the pagan gods were made known to her as to a counsellor and a mouthpiece.

She sometimes wrote her soothsayings upon palm leaves, which she laid at the entrance of the cave, suffering the winds to scatter them and bear them whither the gods directed. To the Cumæan sibyls is attributed the authorship of the famous sibylline books, of which many strange stories are told, but of which very little is left that can be regarded as genuine. It is said that she foretold the eruption of Vesuvius, in which Pliny perished and the cities of Herculaneum and Pompeii were destroyed. She declared of herself: "Why must I publish my song to every one? And when my spirit rests after the divine hymn, the gods command me to prophecy again, so that I am entirely on the stretch, and my body is so distressed that I do not know what I say; but the gods command me to speak." If we substitute in the latter expression the word spirits for gods, we have a declaration identical with those of the spirit mediums of the present day.

The abode of the Delphian sibyl or Pythia was in strong contrast with that of the Cumæan oracle. It was situated in the delightful region of Mount Parnassus, sparkling in sunlight and fragrant with bloom. The superb temple of Apollo was built over a similar chasm as that where the Cumæan sibyl held her seances, so that it was secured from the approach of the vulgar. On its former site certain clefts in the rock are still visible, one of which forms a deep cavern, into which travelers, by clinging to its rugged sides, may descend as far as they dare. They then experience effects similar to those produced by nitrous oxide or laughing gas; and one writer, who has explored these caverns, asserts that it is this gas that produces the effects spoken of. This, however, is, according to geological principles, highly improbable; and we rather suppose it to be some bituminous vapor, which (according to our present knowledge concerning petroleum and its derivatives, such as naphtha, ether, rhigolene, chymogene, etc.) has an effect, exhilarating, hypnotic, and anæsthetic, similar to that of nitrous oxide. All the descriptions agree that bituminous odors are exhaled from these volcanic chasms. Plutarch informs us that the most celebrated Pythia who served the Delphian oracle in the temple of Apollo was a beautiful young country girl from Libya, named Sibylla. From this was the name sibyl derived, and it was afterwards given to all clairvoyants of her day. Plutarch further says, concerning the first sibyl: "Brought up by her parents in the country, she brought with her neither art nor experience, nor any talent whatever, when she arrived at Delphi to be the oracle of the gods;" and further, he says: "The verification of her answers has filled the temple with gifts from all parts of Greece and foreign countries." How very much like the innocent young mediums of today, who are often claimed to give the most astonishing revelations from the other world without ever having had the advantages of a scientific education! The sibyls of the ancients had, however, the advantage of the support, assistance, and promptings of a class of men highly interested in their reputation, the priesthood of the period; and this class not only consisted of the most educated individuals, but of men who had the greatest opportunity of obtaining information withheld from the vulgar.

When we compare with this state of things the position of our mediums now, who obtain little support from the in

telligent, and none among the priesthood of the present day, we cannot help being surprised at their success and the number of their dupes: our surprise is chiefly at the ignorance and credulity of those who patronize such things in the nineteenth century.

CAMS.

There are several devices in mechanics which are important and even indispensable, that are used under protest. In this class we have irregular cams, at once the most useful and the most abused things in the mechanical world.

There is not a loom deftly weaving its delicate designs which is not dependent on cams. Sewing, knitting, and printing machines, a host of ponderous as well as delicate machinery, depend on cams to give one movement here, and another there; yet after all a cam which is in perfect proportion in all its parts is rarely seen. It is no uncommon thing to see a lever provided with an infinitesimal friction roller which is intended to turn on a pivot four fifths its size. This little roller must fit a groove in a cam which revolves at such speed as would drive it at the rate of thousands of revolutions per minute, if it would revolve; but the oil is forgotten, it heats, sticks, cuts itself and the cam; and then comes lost motion, noise, and destruction to the machine. Perhaps a larger wheel or roller is used, for instance, on the periphery of a cam. This wheel is a mere disk, with a hole bored through the center. It is placed on a stud on a lever, and assigned to a duty as heavy as that of the shaft which carries the cam. Is it any wonder that it soon wobbles, cuts the cam, and works unsteadily?

Of course the remedy for this is obvious. The rollers should be made as large as possible, of good material and well hardened. The roller bearings should be of the proper proportion and well fitted, and provided with some means of continuous lubrication.

The cam should be smooth, without the slightest scratch or cut, and should be made as far as possible so that it will not catch dust and dirt. If any part of a machine needs cleaning often, it is a cam; yet it is not an infrequent thing to see a mass of gum, lint, and grit stowed away in a cam, cutting away its usefulness.

BAROMETRIC OBSERVATIONS.

In a recent issue we briefly described a simple way of keeping a barometric record, by the aid of which farmers and others might soon learn to predict weather probabilities. We believe that it is not generally realized how useful an instrument the barometer is, even in unexperienced hands; for certainly were farmers thoroughly informed as to the meaning of its indications, we should hear much less of gathered crops spoiled by untimely and unforeseen rains. The ordinary mercury barometer can if properly constructed generally be relied upon to indicate approaching weather at least twelve hours ahead; and this because the transmission of pressures to a mass of air is very easy, so that the barometer is sensible to variations therein even over long distances. For good work the simple mercury or the aneroid barometer should be obtained. Little confidence can be placed in those which have a dial and an index which points to words descriptive of the state of the weather. The necessary mechanism causes sufficient friction to prevent slight changes of pressure affecting it, and moreover the words "fair," "variable," "rain," etc., convey a wrong impression of the instrument; for the barometer does not indicate by the absolute height of the mercury, but, by its rising or falling, the kind of weather we are to expect, and this change is not shown on the index. A diminution of barometric pressure is almost always the consequence of the approach of the center of one or sometimes of several rotary storms, which move and travel at a certain distance from the point of observation. These movements are followed by changes of winds which carry rain. A falling barometer is therefore always indicative of changes in weather; but contrary to a general opinion, rain does not fall at the moment when the barometric column attains its lowest point. It is only a certain time after the minimum that this phenomenon is ordinarily pronounced; and by repeated observations, based on this fact, M. Gobin of Lyons, France, has been enabled to prepare a series of concise barometric laws, which he has recently published and of which we give the substance below.

If the barometer, after having been high, descends, a change of wind will probably occur twelve hours afterwards. This change will be without rain or with very little rain. When the barometer stops in its falling without descending lower before rising again, rain will come twelve hours after the stoppage. If the mercury remains low, the rain will persist, and fine weather will not come again until ten or twelve hours after the column commences regularly to rise. Sometimes this interval extends to sixteen or eighteen hours, but this is rare.

If, while low, the mercury oscillates slightly up and down, bad weather will persist, with, however, occasional clearing. These alternations of rain and shine will be more pronounced as the oscillations are greater, and will follow the movements of the barometric column at shorter intervals than those noted in the law above given.

Finally, if, as often happens, the mercury, after reaching its lowest point, immediately ascends in a continuous and regular manner, rain will come inside of twelve hours after the mercury touches the minimum; but it will last but a short time, and will soon give place to fine weather.

A GOOD coating for outside brickwork is made by mixing clean river sand 20 parts, litharge 2 parts, quicklime 1 part, and linseed oil sufficient to form a thin paste. It is also useful as a cement for broken stone, drying exceeding hardly.

THE CENTENNIAL EXPOSITION.

The formal programme of the grand ceremonies, to take place in Philadelphia on July 4, has been made public. After the military parade has concluded, the literary exercises will be held on a large platform in rear of Independence Hall. They will include the reading of the Declaration of Independence from the original document, by Mr. Richard Henry Lee, of Virginia, grandson of the mover of the Declaration in the Continental Congress, the singing of a hymn of welcome by Dr. O. W. Holmes, a national ode by Mr. Bayard Taylor, and a Brazilian hymn of greeting, composed at the request of Dom Pedro. An oration by Hon. W. M. Evarts, which is next in order, will be followed by the Hallelujah chorus and Old Hundred, chanted by the chorus and audience. The proceedings are as simple as those at the Centennial Exhibition opening, and will doubtless be fully as impressive.

Dom Pedro is justifying his reputation as a most indefatigable sight-seer. He is "doing" the Exposition in a way that leaves no doubt but that he makes himself familiar with the appearance and use of every object to which his attention is attracted.

The steady growth thus far in attendance is the best evidence of increasing interest in the fair. During the first week, omitting the opening day, the average of paying visitors was 12,210; at the present time the daily average is over 30,000.

The first of what it is hoped may be a series of industrial excursions recently visited the Exposition. The excursionists numbered 3,631, and were the employees of the Singer Sewing Machine Company. A number of students from the Massachusetts Institute of Technology have been encamped on the Pennsylvania University grounds for some time past, and, with their instructors, are making a careful study of the mechanical part of the show. The display of

RUSSIA

in Machinery Hall is gradually approaching completion. A large partition has been erected, covered with cloth, on which are shown rolls of iron and copper; and a circular stand has been built for the exhibition of different iron and other ores and metals. Around the base of the stand and on the lower shelves are disposed samples of iron and copper. A heavy slab of the latter metal, surmounted by a beautiful mass of malachite, covers the upper portion. There are two other stands in the form of obelisks, against which are arranged in tasteful manner a large number of forms of sheet, bar, and angle iron, boiler iron, and tram and chain work. Numerous stout iron bars are tied into knots without showing the slightest flaw; and specimens of angle iron and long rails are exhibited, twisted into sharp spirals. In the northern half of the section is a fine collection of models of ships, dockyards, and workshops. There is one large model of a shipyard and marine railway, showing the manner in which the largest ships are built and launched. A model of a dry dock is fitted with every timber and requisite piece of machinery, all made on an exactly reduced scale. A fine exhibit is made of heavy work in iron and steel, chains with huge links three or four inches in thickness, steel tires for locomotives, and heavy arched beams of angle iron.

THE SUGAR APPARATUS,

next to the Corliss engine, may be considered as the most prominent exhibit in the Machinery Hall. The gigantic vacuum pan is elevated on great iron columns, three stories high. Inside are four copper serpentine, and into these steam is led. The circulating pump and the centrifugal machines are placed on the first floor. On the second floor is a large receiver which receives the contents of the pan after concentration, in the shape of a dense mass of semi-fluid material, a magma. This goes into the centrifugal machines, which separate the sugar from the molasses. The great vacuum pan is exhibited by Messrs. Colwell and Brother, of New York; it is 8 feet in diameter, and, in a single operation of three hours in duration, can produce fifteen hogsheads of sugar.

THE CARRIAGES

are grouped in an unpretending structure of corrugated iron, immediately in rear of the Main Building. There are 430 American and 20 foreign exhibitors, and the display seems to be one of the most attractive to the general public in the entire fair. Many of the vehicles embody novel appliances, others are remarkable for beauty of finish. Messrs. Brewster & Co., of Broome street, this city, besides a superb display of carriages of all kinds, exhibit two buggies for one and two persons which weigh respectively but 132 and 214 lbs. These have a new side bar attachment, which secures ease of travel. A new feature in one of the sleighs is a small wire sieve on the dash to keep out drift snow. Another novelty is the extension of the runners above the dash for a height of five and a half feet. These are surmounted with red horse plumes. The general effect is striking and handsome. Messrs. Studebaker Brothers, of South Bend, Ind., exhibit a wagon for country roads, with the body and running gear left unstained, in order to show the workmanship, which is excellent. The body is of sugar maple, the axle of hickory, and the hubs of birch. The same firm also display a new wheel, the spokes of which have sloping shoulders, in order to fit them for resisting greater strain. Two Philadelphia firms make a joint exhibit of carriage and harness. The former is plain and handsome. The visitor is attracted to this display by the ingenious idea of attaching to the vehicle four horses, superbly carved in wood and wearing an elegant gold-mounted harness. The animals are painted gray, and so cleverly have both artist and sculptor done their work that at a short distance the figures have been

frequently mistaken for life. Of the large American coaches and carriages, it is hardly necessary to particularize any on the ground of relative superiority. Their characteristic is lightness and elegance of form, combined with the evidences of the highest skill on the part of painters and varnishers.

THE FOREIGN VEHICLES

are exhibited chiefly by English, Canadian, Russian, Australian, and Italian makers. Some of the English carriages, notably the drags, are objects of much curiosity to country visitors. One vehicle of this last-mentioned description is built expressly for picnic parties. It is so put together that the various portions of the carriage and fittings form tables, and the roof is fitted with an ingeniously arranged sun shade. A novel phaeton is one which has recently been introduced into England, and which looks like a Russian droshky. It is hung very low on high wheels. A very elegant brougham, built by a London firm, has an edging of vulcanite on the cloth of the window sashes, which prevents wear. C and under springs are used in all the English carriages, and the tires of wheels and forgings are of Whitworth metal. The Italian makers are represented by two cabs, resembling the English hansom, except that the passenger gets in from behind instead of in front. The driver's seat is in rear and above the door.

A curious feature of the Russian exhibit is a light trotting wagon. The running gear is hung on four small wheels, and above it rests the driver's seat, a long board covered with blue plush. A greater contrast than that afforded by this wagon, as compared with the trotting sulky in use in this country, can hardly be imagined.

Canada exhibits some fine sleighs, among which is one capable of accommodating six people. The seats are placed in tiers, the front one being the highest and the others gradually descending. The body is hung on a double set of runners, in order to facilitate turning the vehicle. There are also some fine cutters, beside coaches, buggies, etc.

The French exhibit, for some inexplicable reason, is located in the Main Building. It includes a drag of admirable build, besides a large number of smaller carriages, all remarkable for elegance of design. The

CARRIAGE METAL WORK

exhibited embraces specimens of axles, bolts, screws, whip sockets, springs, mountings in gold, silver, and nickel, bows, curtain attachments, etc., all arranged in handsome cases. There is one German exhibit in this section, principally of axles and springs. Children's carriages are also displayed in profusion, and some are of exquisite design. There is also a large collection of bicycles, among which is

A DOG VELOCIPED

This is a curious affair, having three wheels, two large ones, between which the rider's seat is located, and one small guiding wheel in advance. Inside the felloes of the large wheels are broad bands of perforated metal, and the spokes are so disposed as to lie on each side of these bands, like the bars of a cage. It is stated that the dogs are placed between the spokes and on the bands; then, by their attempts to run ahead, something like those of the squirrel in its revolving cage, the wheels are rotated and the vehicle impelled. This is the description given, but we are inclined to doubt the practicability of the arrangement.

THE RAILWAY CARS

are all American. The Harlan and Hollingsworth Company, of Wilmington, Del., exhibit one broad and one narrow gage carriage. The broad gage car is superbly decorated with mirrors and gilding, and its interior woodwork is a marvel of artistic workmanship. The narrow gage car is of plainer construction. The Jackson & Sharpe Company display a parlor car built for the state use of the Emperor of Brazil. It is constructed in sections, so that it may be taken apart and stored in the hold of a vessel. In the front portion is a boudoir fitted up with drab morocco seats, relieved by heavy magenta-colored fringes. The carpet is a delicate drab covered with a tasteful flower pattern, and the curtains are green and gold. The furniture consists of elegant cabinets, one for books, another to serve as a sideboard. Light is obtained from small stained glass windows at the top. Adjoining the boudoir are a reading room, furnished in blue, and a writing room in crimson. Next to these is the sitting room, plainly fitted with cane-seated walnut chairs, but having superbly inlaid woodwork.

The Pullman Car company exhibits one of its magnificent hotel cars, containing all the improvements in the shape of kitchens, china and linen closets, refrigerators, etc. The refrigerator, we notice, is a square box hung under the car. Another new feature is a large flange on the wheels, which, should the vehicle run off the track, will catch on the rail and prevent its going further.

THE STREET RAILWAY CARS

are finished with decorations of the most elaborate description. One built by a Boston firm has a new running gear, said to reduce friction greatly, a patent attachment for putting on a new brake shoe, and a novel arrangement for lowering and raising the pole to suit the varying size of horses. A noticeable feature of a car built by Jones & Co., of Troy, N. Y., is the exterior coloring, which is in imitation of one of the Highland plaids, laid on in a broad band around the body. This is done in deference to the fact of the car being intended for use in the Highland district of Boston. Messrs. Stephenson & Co. also display some street cars, embodying many of their recently patented improvements.

The remaining contents of the carriage building we shall describe in our next issue, in which a full account of the Fourth of July ceremonies will also appear.