Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.
PUBLISHED WEEKLY AT
No. 361 BROADWAY, NEW YORK.

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada	$3 00
One copy, six months, for the U. S. or Canada	1 50
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The Scientific American Supplement

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Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 6, 1888.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 666.

For the Week Ending October 6, 1888.

Price 10 cents. For sale by all newsdealers.

HOW BEST TO AVOID COLLISION AT SEA.

The recent collision between the steamers Thingvalla and Geiser, the latter being lost, has opened anew in England the discussions regarding lights and signals. The principal objections to such codes of signals as have, as yet, been devised is that, while they give the course being held with admirable promptitude, they do not and cannot give the exact parallel upon which the ship is advancing, if there be any wind, and it is principally under such conditions that danger menaces. Thus, if the signal meaning a stranger is advancing from E. by N. should come over the port bow, the wind being abeam or quartering, the information would be valueless, and indeed misleading, for, should the helm be put a-port, the ship so heeding might only go out of her way to meet the stranger, while, had she heard and heeded no signal, and held her course, she would have run free and clear. Capt. Colomb and Admiral De Horsey have argued the electric side-light question in public letters *pro* and *con*. The Admiral has faith in this system because the lights can be easily regulated in intensity to suit the weather. Another authority proposes electric lights with what he calls a "holophote" reflector, the same to be put on the bridge for the use of the watch officer. An account says: The handle by which this light can be moved is to be regulated absolutely by the position of the helm. When the helm is moved, a detent is released and the ray of light sweeps over the water, giving the same signal to a passing vessel as the driver of a vehicle gives with his hand. When the light has completed its sweep, it is to be automatically shut out.

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COLORED LIGHT TRIALS WITH THE INSANE.

The experiments with colored lights in the treatment of the insane made recently at Alessandria, Italy, are being much discussed by the medical faculty, though getting little credence; the cures, if cures were really made, being attributed to unusual treatment and painstaking attention on the part of the medical staff because of the color trials rather than to anything in the theory itself. In the evidence transmitted by Dr. Ponza, he says rooms were selected with as many windows as possible, the walls of the rooms being painted the same color as the window panes. A patient suffering from melancholia, who would not eat, was placed in a room with bright red walls and windows. In three hours he became quite cheerful, and asked for food. Another lunatic, who always kept his hands over his mouth to keep out air and nourishment, was placed in the same room, and the next day was much better and ate with a hearty appetite.

A violent maniac was placed in a blue room, and became quiet in an hour. Another patient, after spending a whole day in a violet colored room, was completely cured. American and English medical authorities seem to regard these cures as effects rather than causes of the treatment, induced, they argue, not because the light was colored, but because it was a novel sensation, making the patients to forget their inclinations, as pebbles put into the ear of a balky horse will cause him to forget his pranks; a sudden bath or shock might have the same transitory effect.

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Manufacture of Light without Heat.

Prof. Oliver J. Lodge has been endeavoring to manufacture light by direct electric action without the intervention of heat, utilizing for the purpose Maxwell's theory that light is really an electric disturbance or vibration. The means adopted is the oscillatory discharge of a Leyden jar, whose rate of vibration has been made as high as 1,000 million complete vibrations per second. The waves so obtained are about three yards long, and are essentially light in every particular except that they are unable to affect the retina. To do this they must be shortened to the hundred-thousandth of an inch. All that has yet been accomplished, therefore, is the artificial production of direct electrical radiation, differing in no respect from the waves of light except in the one matter of length. The electrical waves travel through space with the same speed as light, and are refracted and absorbed by material substances according to the same laws. We only need to be able to generate waves of any desired length in order to entirely revolutionize our present best systems of obtaining artificial light by help of steam engines and dynamos, which is a most wasteful and empirical process.

In a paper given in *Nature*, Dr. Lodge further discusses the subject as follows:

The conclusions at which we have arrived, that light is an electrical disturbance, and that light waves are excited by electric oscillations, must ultimately, and very shortly, have a practical import.

Our present systems of making light artificially are wasteful and ineffective. We want a certain range of oscillation, between 7,000 and 4,000 billion vibrations per second; no other is useful to us, because no other has any effect on our retina; but we do not know how to produce vibrations of this rate. We can produce a definite vibration of one or two hundred or thousand per second; in other words, we can excite a pure tone of definite pitch, and we can command any desired range of such tones continuously by means of bellows and a key board. We can also (though the fact is less well known) excite momentarily definite ethereal vibrations of some millions per second, as I have at length explained; but we do not at present seem to know how to maintain this rate quite continuously. To get much faster rates of vibration than this we have to fall back upon atoms. We know how to make atoms vibrate; it is done by what we call "heating" the substance, and if we could deal with individual atoms unhampered by others, it is possible that we might get a pure and simple mode of vibration from them. It is possible, but unlikely; for atoms, even when isolated, have a multitude of modes of vibration special to themselves, of which only a few are of practical use to us, and we do not know how to excite some without also the others. However, we do not at present even deal with individual atoms; we treat them crowded together in a compact mass, so that their modes of vibration are really infinite.

We take a lump of matter, say a carbon filament or a piece of quicklime, and by raising its temperature we impress upon its atoms higher and higher modes of vibration, not transmuting the lower into the higher, but superposing the higher upon the lower, until at length we get such rates of vibration as our retina is constructed for, and we are satisfied. But how wasteful and indirect and empirical is the process. We want a small range of rapid vibrations, and we know no better than to make the whole series leading up to them. It is as though, in order to sound some little shrill octave of pipes in an organ, we were obliged to depress every key and every pedal, and to blow a young hurricane.

I have purposely selected as examples the more perfect methods of obtaining artificial light, wherein the waste radiation is only useless, and not noxious. But the old-fashioned plan was cruder even than this; it consisted simply in setting something burning, whereby not only the fuel but the air was consumed, whereby also a most powerful radiation was produced, in the waste waves of which we were content to sit stewing, for the sake of the minute, almost infinitesimal, fraction of it which enabled us to see.

Every one knows now, however, that combustion is not a pleasant or healthy mode of obtaining light; but everybody does not realize that neither is incandescence a satisfactory and unwasteful method which is likely to be practiced for more than a few decades, or, perhaps, a century.

Look at the furnaces and boilers of a great steam engine driving a group of dynamos, and estimate the energy expended; and then look at the incandescent filaments of the lamps excited by them, and estimate how much of their radiated energy is of real service to the eye. It will be as the energy of a pitch pipe to an entire orchestra.

It is not too much to say that a boy turning a handle could, if his energy were properly directed, produce quite as much real light as is produced by all this mass of mechanism and consumption of material.

There might, perhaps, be something contrary to the laws of nature in thus hoping to get and utilize some specific kind of radiation without the rest, but Lord Rayleigh has shown in a short communication to the British Association, at York, that it is not so, and that, therefore, we have a right to try to do it.

We do not yet know how it is true, but it is one of the things we have got to learn.

Any one looking at a common glow worm must be struck with the fact that not by ordinary combustion, nor yet on the steam engine and dynamo principle, is that easy light produced. Very little waste radiation is there from phosphorescent things in general. Light of the kind able to affect the retina is directly emitted, and for this, for even a large supply of this, a modicum of energy suffices.

Solar radiation consists of waves of all sizes, it is true; but then solar radiation has innumerable things to do besides making things visible. The whole of its energy is useful. In artificial lighting nothing but light is desired; when heat is wanted it is best obtained separately, by combustion. And so soon as we clearly recognize that light is an electrical vibration, so soon shall we begin to beat about for some mode of exciting and maintaining an electrical vibration of any required degree of rapidity. When this has been accomplished, the problem of artificial lighting will have been solved.

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Removal of Rust.

A method of removing rust from iron consists in immersing the articles in a bath consisting of a nearly saturated solution of chloride of tin. The length of time during which the objects are allowed to remain in the bath depends on the thickness of the coating of rust; but in ordinary cases twelve to twenty-four hours is sufficient. The solution ought not to contain a great excess of acid if the iron itself is not to be attacked. On taking them from the bath, the articles are rinsed in water and afterward in ammonia. The iron, when thus treated, has the appearance of dull silver; but a simple polishing will give it its normal appearance.

The Waste of Anthracite and the Exhaustion of the Supply.

The statistics of coal production, which we publish in our usual market report, show that during the month of August the shipments of anthracite from the Pennsylvania mines to market amounted to 4,097,563 gross tons, which is the largest anthracite output ever made in one month, and is at the rate of 49,000,000 tons a year.

During the eight months of the present year, the shipments of anthracite to market have amounted to 23,619,291 tons, being 1,755,495 tons in excess of the shipments during the corresponding period in 1887. During the months of September, October, November, and December, 1887, the shipments amounted to 12,777,222 tons, and as we shall certainly largely exceed that amount this year, it appears probable that we shall send to market this year 37½ or 38 million tons of anthracite.

If we include the coal sold and used at the mines, say 6 per cent of the shipments, the grand total output for the year will probably amount to 40,000,000 gross tons.

The average waste of anthracite in mining and preparation for market has been carefully estimated from many reliable data by the Geological Survey of Pennsylvania, as follows :

Coal left in pillars, etc.	45	per cent.
Coal lost in mining by blasting, etc.	15	"
Breaker waste 16 per cent of 40 per cent	6·4	"
Total loss	66·4	"

Or only about *one-third of the coal goes to market;* if therefore we produce 40,000,000 tons this year, it represents the exhaustion of 120,000,000 tons of our available supply, and this does not now much, if at all, exceed 9,000,000,000 tons.

At the present rate of production and present percentage of waste in mining, our entire supply of anthracite coal will last only 75 *years.*

This statement is not based on any mere *guess*, but is founded on reliable data, and it is so startling in its significance that it should certainly attract the attention of the managers of our great coal companies, and even of the government of the State of Pennsylvania. It is not claimed that we have yet reached our maximum production, and every increase means that the coal will be worked out in proportionately less time than here stated.

Long before the supply has been exhausted, the demand for anthracite will have exceeded the supply, and prices will be limited only by the prices of other fuels; and as cheap fuel is the very foundation of industrial prosperity, it is not difficult to imagine the resulting effect on the industries of a large part of this country.

The present enormous, disgraceful, and unnecessary waste in mining anthracite should be stopped, and if the interests of the great coal companies are not sufficient to impel them to do this, then the government of the State, which is the guardian of the citizens' interests, should intervene to save these from the disastrous consequences of the spendthrift policy of those who now monopolize our invaluable supplies of this fuel.—*Eng. and Min. Jour.*

Vegetable Cows.

Several natural orders of the vegetable kingdom include plants that are characterized by the secretion of a fluid closely resembling milk in appearance and consistency, and a familiar example of these is to be seen in our common milkweed (*Asclepias cornuti*), which is well known to everybody. In some plants, this milky fluid is of the most venomous nature; in others, it possesses active medicinal virtues; in others, it yields a product (such as India rubber and gutta percha) of the highest importance to the arts and industries; and, in others still, it proves of value as a human aliment. Since the same general properties characterize the plants of each natural family, it seems an anomaly that, in the same order, we should find the species of one genus producing a lactescent fluid of a highly poisonous nature, and those of another yielding one that is entirely innocuous. Yet such is often the case, and we have a striking example of it in the bread fruit order, the Artocarpaceæ, which, on the one hand, includes the celebrated upas tree of Java, which, when pierced, exudes a milky juice containing an acrid virulent poison (antiarin), the smallest quantity of which will kill the largest animal, and, on the other, the famous *Brosimum utili* of South America, which yields a copious supply of rich, wholesome milk, of as good a quality as that from the cow. There are several other instances in the vegetable kingdom of such an association, in the same natural order, of plants that produce a noxious lactescent juice with others which yield a wholesome one adapted for man's use, and which may therefore be designated as "vegetable cows." To speak only of the latter class, the most remarkable example is the species of *Brosimum* just mentioned, which was discovered and made known by the celebrated traveler Humboldt. This tree forms extensive forests on the mountains near the town of Coriaco, and elsewhere along the sea coast of Venezuela—growing to upward of one hundred feet in height, with a trunk six or eight feet in diameter, and branchless for the first sixty or seventy feet of its height. It is popularly known as the cow tree, Palo de Vaca, or Arbol de Leche. "Its milk, which is obtained by making incisions in the trunk, so closely resembles the milk of the cow, both in appearance and quality, that it is commonly used as an article of food by the inhabitants of the places where the tree is abundant. Unlike many other vegetable milks, it is perfectly wholesome and very nourishing, possessing an agreeable taste, like that of sweet cream, and a pleasant balsamic odor, its only unpleasant quality being a slight amount of stickiness. The chemical analysis of this milk has shown it to possess a composition closely resembling some animal substances, and, like animal milk, it quickly forms a yellow, cheesy scum upon its surface, and, after a few days' exposure to the atmosphere, turns sour and putrefies. It contains upward of thirty per cent of a resinous substance called *galactin* by chemists." (*Treas. of Botany.*) Speaking of this tree, Humboldt says : "They [the natives] profess to recognize, from the color and thickness of the foliage, the trunks that yield the most juice, as the herdsman distinguishes, from external signs, a good milch cow. Amidst the great number of curious phenomena that I have observed in the course of my travels, I confess there are few that have made so powerful an impression on me as the aspect of the cow tree. A few drops of vegetable juice recall to our minds all the powerfulness and fecundity of nature. On the barren flank of a rock grows a tree with coriaceous and dry leaves. Its large woody roots can scarcely penetrate into the stone. For several months in the year, not a single shower moistens its foliage. Its branches appear dead and dried, but when the trunk is pierced, there flows from it a sweet and nourishing milk. It is at the rising of the sun that this vegetable fountain is most abundant. The negroes and natives are then seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow and thickens at the surface. Some empty the bowls under the tree itself, others carry the juice home to their children."

In the Dogbane order, the Apocynaceæ, which includes plants that are mostly of a venomous nature and possess an exceedingly acrid and drastic juice, we have a second example of a tree that secretes a wholesome, milk-like fluid. This is the *Tabernæmontana utilis*, the cow tree of Demerara, or hya-hya of the natives. This tree grows in abundance in the forests of British Guiana, and its bark, when tapped, yields a copious supply of thick, sweet milk, resembling that of the cow in appearance, but rather sticky from the presence of caoutchouc. This milk mixes freely with water, is of a pleasant flavor, and the natives employ it as a refreshing beverage.

Two "cow trees" are found in the order Sapotaceæ, which embraces numerous plants valuable for their succulent fruits, such as the marmalade, star apple, etc. One of these is the *Mimusops elata*, called by the natives massarandaba or aprain, and which Professor Orton, in the *Andes and the Amazons*, describes as one of the noblest trees of the forests of Para. It stands from 180 to 200 feet in height, is 20 feet in circumference, and is crowned with a vast dome of foliage. The milk yielded by the bark has the consistency of cream, and is used for tea, coffee, and custards. It hardens by exposure, so as to resemble gutta percha, which, indeed, is the product of a Malaisian tree belonging to the same natural order. The other tree is the *Mimusops balata*, or bully tree, of English, French, and Dutch Guiana. The milk of this species is sometimes employed with tea or coffee, instead of cow's milk, but has the disadvantage of hardening very rapidly upon exposure to the air.

The natural order Asclepiadaceæ consists of plants that are almost always milky, and the milk is usually acrid and bitter, and always to be suspected, yet one of the plants of the family, *Gymnema lactiferum*, the cow plant of Ceylon, called by the natives kiriaghuna, yields a milk which the Cingalese make use of as food.

Another example of a "cow tree" belonging to a dangerous natural order, the Euphorbiaceæ, which embraces plants having acrid and purgative juices, is the *Euphorbia balsamifera*, or Tabayba dolce, of the Canaries. Notwithstanding the fact that the plants of this genus have juices that possess very active medicinal qualities, and are in some cases so venomous that they are used as arrow poisons, the juice of the species under consideration is innocuous, and, according to Leopold von Buch, is similar to sweet milk, and is eaten as a delicacy after being thickened into a jelly.

Still another "cow tree" is found in the order Clusiaceæ or Guttiferæ, which embraces plants that secrete an acrid, purgative, yellow gum resin, such as gamboge. This tree is the *Clusia galactodendron*, a native of Venezuela, where it is known as Palo de Vaca. It has a thick bark, covered with rough tubercles, and its internal tissue becomes red when exposed to the air. In extracting the milk, the inhabitants make incisions through the bark till the wood is reached. These cuts are said to be made only before full moon, it being imagined that the milk flows more freely then than at any other time. One tree will yield a quart in an hour. The milk is freely used by all, especially by children, although it has a somewhat astringent taste.

In the order *Moraceæ*, which includes the mulberry and fig, there are several species of *Ficus* that are known as cow trees, and the milky fluid of which is bland and used as a beverage, although in most of the species of the genus the juice is exceedingly acrid.

Fall Cleaning Up.

The *Manufacturers' Gazette* suggests to its readers that now is a capital time to prepare for winter, both inside of the mill and around the outside premises. Taking advantage of the cool, dry, and clear days to repaint sash, clean windows, and paint up your wooden buildings will be infinitely better than to leave things all demoralized for winter storms to beat upon. Now that the days are visibly shortening, it will soon be that daylight will be greatly retarded by dirty windows. Put in the odd panes of glass; do a little whitewashing or painting; in fact, clean up thoroughly. Make the mill as cheery and comfortable as possible for the help during the dark wintry days. Have your circulation piping carefully looked over, and all leaky valves and joints packed, to prevent unnecessary waste of fuel. Patch up those holes and cracks in the brickwork and floors. See that all outside doors are in working order and weatherproof. Perhaps the roof will bear a little investigation and renewing in spots.

These are all little things, but they require attention at the proper time, for if allowed to go loose they will count up in the aggregation of shiftlessness.

Out in the yard we may have a pile of scrap iron, odd pieces of lumber, and what not, which may be required during the winter. Gather this stuff all together and cover it up with a board roof if possible; if not, use old drier canvas. Anything is better than to have it snowed under and hunted for some night with a lamp and shovel with the thermometer around zero. Odd machinery, like pulleys, gears, or pieces of shaft, should be blocked up off the ground, as when not so cared for they settle into the earth, and, if not frozen down, will become badly rusted at the ground contact. Piping and fittings especially should be housed, as they are so liable to damage by lying loose outside.

The Congress of American Physicians and Surgeons.

The above organization began its first triennial meeting in Washington, D. C., on the afternoon of September 18, the business of the assemblage filling up pretty well the remainder of the week. The attendance at first included 200 members, which at the later sessions was considerably increased. Dr. John S. Billings, the eminent sanitarian, was elected president. The papers were read before eleven sections, each section representing a body of specialists. The great number of papers thus disposed of makes even a recapitulation of their titles an impossibility. One, however, may be noted as being of sadly increased interest at the present moment. Major G. M. Sternberg read a paper upon "Recent Investigations Relating to the Etiology of Yellow Fever." He reviewed the germ investigations of Drs. Freire, Finlay, and Gibier, and announced his belief that the specific microbe of yellow fever had not yet been found. Major Sternberg is still engaged in his researches, but gave no promise that an effectual yellow fever prophylactic would be ever found.

Electric Street Cars in New York City.

Electric traction cars, in the place of horse cars, began making trips in the public service on the Fourth Avenue line, New York City, on September 17, the Julien storage battery system being employed. The battery for a car consists of 144 cells, made to slide under the seats from the outside on trays. The general construction of the Julien battery, and the method of charging it, was given in the SCIENTIFIC AMERICAN of May 7, 1887. Each truck carries a motor capable of propelling four cars, to guard against danger of a breakdown, and the battery as furnished to the car is designed to afford sufficient power to drive it thirty to forty miles with an ordinary load. The same motor that propels the car furnishes the light to supersede the oil lamps heretofore used. The electric cars are two feet longer than the horse cars on the same line, which, it is said, the company intend to change into electric cars, should the new system prove to be what is hoped for in practical use for city travel.

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THE idea of a nation with the wealth and mechanical skill of the United States having to go abroad for its guns for warfare is ridiculous. Sporting arms, equal in workmanship to any manufactured in the world, are made in this country, and there is no reason why the heavier ordnance should not also be made here. There is a bill pending before Congress to appropriate ten millions a year for this purpose. If the bill passes, it will open an extensive field to American manufacturers.—*Stoves and Hardware.*