# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

**No. 361 BROADWAY, NEW YORK.**

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NEW YORK, SATURDAY, MAY 23, 1885.

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**THE SCIENTIFIC AMERICAN SUPPLEMENT,**

**No. 490,**

**For the Week Ending May 23 1885.**

Price 10 cents. For sale by all newsdealers.



### COMPRESSED AIR FOR SMALL MOTORS.

A correspondent revives the idea of driving light machinery, requiring less than one horse power, by means of compressed air.

The first essential feature is the means for compressing the air, and this he proposes to accomplish by a windmill.

The air receiver he proposes to construct capable of sustaining a pressure of 3,000 pounds to the inch. Its size will depend upon the use to which it is to be put. For storing air for driving a one horse vehicle for several hours, a cylinder 4' x 2' would be ample.

We thus have a reservoir of force on which we can draw at will, and one which is applicable to a multitude of domestic purposes.

In the case of light vehicles, they may be constructed, let them be observed, with no less beauty than if intended to be dragged after a horse. The rear axle is made to revolve freely, and is provided with a crank at its center. Both wheels are attached rigidly to the axle, or, in order to facilitate turning, one may be left loose, according to the practice of steam fire engines. The forward axle is provided with suitable upright and handle, to direct the course of the carriage. The cylinder of compressed air, which for a light load need not exceed 3' x 9", is placed upon the wagon body, and will accomplish two and a half hours' propulsion, having at the end of this time a residual pressure of 500 pounds. Where the absence from the source of supply will be longer than this, two cylinders, or one of double capacity, may be used. The weight of each cylinder will be about 85 pounds, and double this weight, or if only one large one be used, somewhat less than double, will be no more than the weight of an extra person, the physician's coachman for example.

The connection of the engine, borne by the cylinder, with the axle crank is either direct or by intervening gearing. Where two cylinders are used, they are both connected with the receiver of the engine.

The advantages presented by this system over animate motors are so undeniable that eventually it must supplant them to a large extent. It is admirably adapted for daily service in a hundred different ways. Its first great virtue is the saving of the cost of maintenance. A horse is a continual bill of expense. Whether used or not, it must be daily fed and cared for; whereas our windmill requires only a very light diet of lubricant, and is docility itself. Nor is it apt to grow sick and die. Blankets, hitching straps, and whips will not be called into requisition.

In all previous traction engines, it has been necessary to provide for the great weight of a boiler and its appendages, and we have had consequently a cumbrous mass of machinery ill suited for ordinary use. With compressed air we add no more than the weight of a driver, and our wagon runs off as lightly as at present.

While we have considered only the case of light vehicles, the system is none the less applicable to heavy trucks and drays. The added weight in the latter case need not exceed 450 pounds, and this would be more than compensated for by the saving in expense and the absence of horses from our crowded streets.

There appears to be a wide field for the exercise of inventive genius in the production of compressed air motors and vehicles thereby operated.

### GRAIN IN CAST IRON.

There is cast iron that is so fibrous that a turning chip of twenty feet long has been nursed from a shaft in the lathe, but this iron was of exceptional quality, and was used for the making of a steamboat shaft before forged iron shafts were common. Ordinary cast iron has no fiber—none worthy the name. It is of a granular or cellular structure, and is a conglomerate of material of which iron proper is only one portion. But iron may be so refined, by selection and mixture of ore products, as to present a structure of cells so minute as to be capable of a polish and burnish resembling steel.

This excessive refinement is not always an improvement. A series of experiments in cast irons, comprehending the mixture of the irons, the requirements of heat and fluxes, and the quality of the fuel, shows that for ordinary purposes the reduction of the cellular structure to an approximation to homogeneity is not advantageous; for finish pieces and ornamental work, as the aprons of lathes, and for gear blanks which are to be exposed, and for similar purposes, iron that will receive a silvery luster when polished is excellent; but such iron is devoid of the quality of tension and recuperation—the more open cellular iron will yield and recover better than the closer iron.

For heavy castings, like planer beds and lathe beds, the more open iron is the better; it is less liable to come out of the mould chilled and hardened in spots, and it has a tenacity under severe strain that is not equaled by the finer iron. The mottled color of such iron after being planed sometimes troubles the machinist, who wants to make a good job out of the best materials. The writer's opinion was recently asked in regard to this matter. An eleven ton planer bed had been prepared for setting up, and the recessed V-ways showed a mottled surface—gray and black—as really good soft iron frequently does. It had been suggested that the dark cellular spots were holes where the grain of the iron had been torn out in planing—taking a rank feed for finishing chip. Of course, this was impossible, and yet the open structure of the iron, that was exposed only after the casting skin had been removed, gave the impression of a honeycomb rather than of a solid.

If this structure of the material is not the most elegant when finished, it is absolutely stronger than the closer grained qualities of iron. And it is claimed by some builders of heavy tools that wearing surfaces of such iron are more durable and run easier than those of closer grained iron—that the oil fills the cells, producing and maintaining numberless minute reservoirs of the lubricant. "What sort of a planer bed would fine machine steel make?" asked an intelligent foreman. "There would be required a barrel of oil with drip pipe at each end, as the platen moved." Probably the grain of cast iron and the uses to which it is to be put should be inseparable considerations.

### THE TEETH OF MILLS.

A suggestion that the teeth of reamers could be wisely reduced from the wide flutes so common was made several months ago. Further observation is to the effect that most of the milling machine cutters have teeth too few for their diameters. In shop practice it does not appear to be the rule that the diameter of the mill has any relation to the number of its teeth—the idea appears to be that from root to point the length of a milling tool tooth should be from half an inch to one-fourth of an inch; this without any regard to the diameter of the mill, or the circumferential speed at which it was to run, or the difference of the material on which it was to act.

In a shop of considerable pretensions was noticed a workman attempting to dress a cast steel blank in the milling machine by a mill with teeth of three-eighths of an inch long—the blank being on a vertical arbor and fed up against the teeth of the mill, which was on a horizontal arbor. It was a futile attempt. The workman sprang the upright arbor, and broke out a tooth of the mill. When he was asked why he attempted the job of steel against steel with such a tool, he said that he had dressed brass blanks so the week before. So he had; but they were brass. Brass requires coarse cutters; files for brass should be coarse cut—wide teeth. But for steel the mill should have been very fine toothed.

A coarse toothed mill should revolve very rapidly, or else the feed must be very slow; whereas a fine cut mill may go slow with quite a rapid feed. If the trouble of keeping the mill clean is not taken into account, more rapid work, as well as better work, can be done by the fine tooth mill than by the coarser one. And even then there is not much saved; the workman must attend to his milling machine—it does not feed itself, however much it may run a job through unattended.

It would be well for some competent machinist to prepare a table of diameters of mills with relative sizes (numbers) of teeth, and their adaptation to the work (material) on which they were to be used. It would not be a difficult classification, and might be of great benefit.

### EXPECTED ADVENT OF THE LOCUST.

According to Prof. C. V. Riley, the U. S. Entomologist, we are to experience this year a very extended appearance of the insect known as the Periodical Cicada, *alias* the "17 year locust." Prof. Riley, who has made many original observations on this insect, and who 17 years ago published an account of twenty-two distinct broods, and first announced that there is a 13 year race of the species, states that we shall witness this year the conjunction of two distinct broods, one a 17 year and the other a 13 year brood.

It is 221 years ago, or in 1664, since these two broods appeared simultaneously. The 13 year brood is located principally in the Mississippi Valley, reaching up as far as the mouth of the Missouri, and having its thickest centers in Union County, Southern Illinois, and in Kansas, Missouri, Georgia, Louisiana, Tennessee, and Mississippi.

The 17 year brood is one of the largest of all those known to occur, and will appear on Long Island in Kings and in Monroe Counties, New York, at Fall River, in the southeastern portion of Massachusetts, in parts of Vermont, and very generally in Pennsylvania, Maryland, District of Columbia, Delaware, and Virginia, also in Northwestern Ohio, in Southern Michigan, in Indiana, and Kentucky.

This curious insect, according to race, remains either for 13 or 17 years under ground, developing slowly, and sometimes burrowing far below the frost line. Prof. Riley says that they will begin to rise from the ground about the latter part of May in the more southern portion of the country and early in June in the northern portion, and that the woods will resound with the hoarse rattling noise which the males make, the females being noiseless, a fact which the Rhodian bard Xenarchus recorded in his couplet:

"Happy the Cicada lives,
Since they all have voiceless wives."

The 17 year brood that is to occur this year has been well recorded for the years 1715, 1732, 1749, 1766, 1783, 1800, 1817, 1834, 1851, and 1868. Prof. Riley witnessed it himself in 1868, and while the underground life of the insect has been hitherto inferred only from the periodical appearance of the perfect insect, he has since then been able to establish it by direct observation of the development of the larvæ from year to year.

### Safety Against Fire in Buildings.

A meeting of the Insurance and Actuarial Society of Glasgow was held on April 8, when Mr. A. B. Dansken read a paper on "Notes on Buildings."

Having given a short summary of the various building acts in England and in America, Mr. Dansken said that the London and Liverpool acts were the models for all others in England. In Scotland they had no act really worthy of the name. In Boston and Montreal, on the other hand, the acts were of a more general nature than those in this country, though they contained some excellent provisions which might with advantage be adopted here. The Metropolitan acts contained excellent structural arrangements. Liverpool had paid great attention to regulations for the storing of goods within the boundaries of the borough, while Montreal had special regulations for the erection and use of steam boilers, furnaces, stoves, and such like. Great improvement had recently taken place in the storing of goods, particularly in London and Liverpool, and what was required in Scotland was a general building act similar in its provisions to those of London and Liverpool. The most fruitful sources of fires in dwelling house property were defective hearths and vents (flues), and this was borne out by the fire returns of various cities. The percentage in Glasgow was three times greater than in London, more than double that of Liverpool, and one-fourth more than Manchester. The reason of that, says the *Architect*, was not far to seek, for the Metropolitan Building Act required that hearths "shall be solid for a thickness of seven inches at the least beneath the upper surface of such hearth or slab;" while in Glasgow not only were there no regulations as to hearths, but the practice was to lay them on the bare wood—the most dangerous that could be adopted. Considering how gables and party walls were built in Glasgow, it was not surprising to learn that a great many fires occurred from defective chimneys. In the construction of dwelling house floors Mr. Dansken referred to the present method of deafening by filling in between the joists a layer of ashes or rubbish on loose boards, and suggested that if the space between the joists was filled in with concrete the floor would be practically fireproof. A floor of that kind immediately above shops would confine a fire, or at least retard its progress very considerably, and render the dwelling houses much safer. Were that system adopted in mansion houses, there would be fewer instances of their total destruction. Having given some hints as to how to deal with lightning rods, Mr. Dansken proceeded to refer to warehouse and shop property. As the danger from fire increased proportionally with the size of the building, he thought some legal restrictions should be placed on their limits, for the extra rates charged for large warehouses had had little or no influence in that direction. Within recent years it had become the practice to have ceilings and walls of warehouses wood lined. That very largely increased the risk of fire; but it might be remedied to some extent by having asbestos felt under the wood lining of the ceilings and the space behind the lining of the walls, and filled up at intervals with beding of cement or plaster. Dealing with fireproof iron doors, Mr. Dansken referred to several varieties, but said that he preferred one formed of a combination of corrugated iron and asbestos. With respect to the mode of hinging them, he thought that where practicable the hinges should be bolted through the full thickness of the wall, and that the steps of the doors should be raised higher than the floor level on either side, to prevent liquid flowing from one floor to another. Mr. Dansken concluded by referring to different forms of floors suitable for public buildings, in which a combination of iron and concrete was treated in various ways.

### J. J. Keller.

Mr. J. J. Keller, senior member of the well known chemical house of John J. Keller & Co., of this city, died recently aged 61, the victim of a mistake in the giving of medicine. As a remedy for facial neuralgia his physician prescribed, or intended to prescribe, for him a dose equal to three-quarters of a milligramme of sulphate of atropine. By some error as yet unexplained, the dose given to the sick man was three-quarters of a gramme, or one thousand times more than had been intended. The patient took the dose, became immediately unconscious, and soon after died.

Atropine is an alkaloid obtained from the belladonna plant, or deadly nightshade. It is a very active poison, but a very excellent and wonderful medicine when rightly used. It is especially employed by oculists in treating diseases of the eye, having a remarkable effect in dilating the pupil.

### The Kaolin Beds of Chester County, Pa., and of New Castle County, Del.

BY GRAHAM SPENCER.

For the last fifty years the manufacture of china in this country has been steadily growing, and is now an important industry, and one that is increasing in the quantity as well as quality of its goods yearly. The first pottery in America was established in Philadelphia, about half a century ago, by a man named Tucker, who carried on the business for some time, making very excellent semi-porcelain ware. Since then, Trenton, New Jersey, is the great point of manufacture east of, and East Liverpool, Ohio, west of the Alleghanies. Besides these, Baltimore, Wheeling Steubenville, Beaver Falls, and Cincinnati, and a number of other places have one or more potteries located in them.

The great bulk of kaolin, or china clay, used in the potteries of the United States is mined in this section. The amount of prepared clay shipped last year was nearly twenty thousand tons.

Kaolin results from the decomposition of a rock composed of feldspar and quartz; and is found in pockets or beds, in low and very often swampy ground (I speak of kaolin found in this vicinity), the clay underlying the surface soil holding the water. The amount of covering varies; in some cases being less than eight feet from the surface, and in others as much as forty. The pockets are of an oblong shape, the general direction being northeast and southwest. The kaolin is found bedded against veins of talc, which determine the width of the pocket. The talc is very irregular in its pitch, but eventually cuts the clay out. The talc is in turn bedded against partly decomposed mica schist, and very often against a vein of iron or manganese.

There are no surface indications of kaolin, and it is generally proved by boring, or sinking small shafts. After having determined the position of the deposit, the dirt is stripped off and the clay uncovered, and taken out by means of carts, cars, or derricks, as the case may be. From the situation of the pit, which is generally in the lowest ground, there is no opportunity for drainage after you are down any depth, and constant pumping becomes necessary, not only of surface water, but of large springs, which burst out from the sides of the pit and through the banks.

The clay is taken from the pit to the washing machine, which is a three or four inch shaft, according to the power you have, placed horizontally with knives at right angles, about four inches apart, made of three-inch by inch iron, twelve inches long. The whole is enclosed in a stout framework, with a pulley at one end of shaft connected by belt with main shaft, and an opening made at the other end of the machine for the escape of the clay and sand. The shaft is set in motion, a stream of water turned on, and the clay thrown in the top as fast as a man can shovel it. The sand or quartz coming out with clay and water settles in a box, where it is continually being shoveled out.

The clay, combining with water, and of the thickness of cream, is allowed to run slowly off into a number of troughs for a time, until all the impurities have had a chance to settle. It is then turned into large vats, where it remains until quite thick. It is then pumped into presses, which are a number of wooden panels held together by iron rods—each panel containing a canvas bag. The water escapes through the pores of the canvas, and leaves the clay in such a condition that it can be handled and placed on shelves in the open air to dry, after which it is ready for shipment.

Kaolin, both in a crude state and washed, is much improved by exposure. If placed in piles, and allowed to freeze and thaw during the winter, it will be found much tougher in the spring. A strong, tough clay is of much more value to the potters, as it enables them to make thinner ware. It is said that in the manufacture of the finest ware, in China, one generation mines the clay for the next to use.

The average yield of washed koalin from a ton of crude clay is from thirty to fifty per cent. I have never seen crude clay in any quantity which would yield above that.

The quartz, washed from the crude clay, is of the purest nature; and when pulverized is worth about $12.00 per ton, and is sold to the potters—they using it in the body of their ware, and also with feldspar as as a glaze.

The mica or talc which is washed from the clay, and settles in the troughs, makes a good fire brick.

In conclusion, to give a general idea of the size of the deposits of kaolin in this section, I would say that in the pit I am now working, the clay had been proved at a depth of ten to sixteen feet from the surface, for over 300 feet in length and 80 to 100 feet in breadth; and in depth 50 feet, and still clay. The greatest depth I have ever been down, in any of my pits, is ninety feet, the strata of clay continuing, but which had to be abandoned on account of the expense of keeping the dirt from caving in.

The color of kaolin varies from a pure white to a yellow (as shown in the specimens), the white being more valuable. The yellow and the white clay are often found banked against each other, and running vertically downward, side by side. The clay is hard to excavate, and requires the strongest steel pointed shovel for work, being dug in sods.—*Proc. Eng. Club.*

### Cements for Special Purposes.

The value of a cement is, first, that it should become a strongly cohering medium between the substances joined; and, second, that it should withstand the action of heat, or any solvent action of water or acids. Cement often fails in regard to the last consideration. For waterproof uses several mixtures are recommended, and the following may be mentioned:

One is to mix white lead, red lead, and boiled oil, together with good size, to the consistency of putty. Another is powdered resin, 1 ounce, dissolved in 10 ounces of strong ammonia; gelatine, 5 parts; solution of acid chromate of lime, 1 part. Exposing the article to sunlight is useful for some purposes. A waterproof paste cement is said to be made by adding to hot starch paste half its weight of turpentine and a small piece of alum. As a cement lining for cisterns, powdered brick 2, quicklime 2, wood ashes 2, made into a paste, with boiled oil, is recommended.

The following are cements for steam and water joints: Ground litharge, 10 pounds; plaster of Paris, 4 pounds; yellow ocher, one-half pound; red lead, 2 pounds; hemp, cut into one-half inch lengths, one-half ounce; mixed with boiled linseed oil to the consistency of putty. White lead, 10 parts; black oxide of manganese, 3; litharge, 1; mixed with boiled linseed oil.

A cement for joints to resist great heat is made thus: Asbestos powder, made into a thick paste, with liquid silicate of soda.

For coating acid troughs, a mixture of 1 part pitch, 1 part resin, and 1 part plaster of Paris is melted, and is said to be a good cement coating.

Correspondents frequently ask for a good cement for fixing iron bars into stone in lieu of lead, and nothing better is known than a compound of equal parts of sulphur and pitch. A good cement for stoves and ranges is made of fireclay with a solution of silicate of soda. A glue to resist damp can be prepared with boiled linseed oil and ordinary glue; or by melting 1 pound of glue in 2 quarts of skimmed milk; shellac, 4 ounces; borax, 1 ounce, boiled in a little water, and concentrated by heat to paste. A cement to resist white heat may be usefully mentioned here: Pulverized clay, 4 parts; plumbago, 2; iron filings, free from oxide, 2; peroxide of manganese, 1; borax, one-half; sea salt, one-half; mix with water to thick paste, use immediately, and heat gradually to a nearly white heat.

Many of the cements used which are exposed to great heat fail from the expansion of one or more ingredients in them, and an unequal stress is produced; or the two substances united have unequal rates of expansibility or contractility; the chemical or galvanic action is important. The whole subject of cements has not received the attention it deserves from practical men. Only Portland cement has received anything like scientific notice, and a few experiments upon waterproof, heat-resisting, and other cements would show which cements are the best to use under certain circumstances.—*Van Nostrand's Magazine.*

### A Russian Bath at Home.

Among the new home conveniences recently introduced, is a simple attachment to the ordinary bath tub, by which the luxury of a vapor or medicated bath may be taken in one's own house.

To persons who enjoy the luxury of the Russian bath, but do not reside where such establishments are accessible, the new vapor appliance is a good substitute.

The medicating or disinfecting materials are placed within cylindrical air chambers, and fed drop by drop into the water, and mingle with the steam as it is drawn into the bath tub. The invention has been introduced into some of our city hospitals, and a number of physicians have recommended it for its capability as a deodorizer and disinfecter. A bath may be perfumed by a few drops of any odorous extract, put into the cylinder with the other ingredients. Handsome rooms have been fitted up for exhibiting the practical workings of the new bath apparatus at No. 12 East 23d Street, New York, and persons residing out of the city who may desire to know more about the invention can gain information by addressing John Ponder, at the above place.

### Heavy Electric Light Suits Coming.

The Edison Electric Light Company have commenced suits against alleged infringers on their patents for incandescent electric lighting on a scale which promises to give a large number of lawyers a fine field of labor. The various companies made defendants are the U. S. Electric Lighting Co., the U. S. Illuminating Co., the Consolidated Electric Light Co., the Swan Incandescent Electric Light Co., the Remington Electric Light Co., and the Schuyler Light Electric Co., besides a few prominent users, who, in patronizing these various companies, to this extent dispute the validity or force of the Edison patents.