evolutionists. They are remarkable both on account of the extreme accuracy with which they appear to have been performed, and for the results obtained.

THE ORANGE JUDD HALL OF NATURAL SCIENCE.

The gift of Orange Judd, of this city, one hundred thousand dollars to the Wesleyan University, at Middletown, Conn., to found a Museum of Natural History, and a school of chemistry and technology, is one of the noblest benefactions of modern times.

A few years ago Mr. Judd was a student at that college. He was a poor boy, and compelled to make his way in the world, and encounter at the outset the difficulty of finding any school in which to study the natural sciences. With rare industry and perseverance he has been able to overcome all of these obstacles, and to create for himself a fortune that he now seems disposed to devote to the good of his fellow-men.

The Museum and Laboratory is 62 feet front, and 94 feet deep, and is practically five stories high, as the basement is mostly above the surface. It is built of Portland sandstone, and is essentially fire proof, as the cornices, doors, and window frames are of iron, and the roof of slate, and an iron and brick floor, supported on brick and iron pillars and walls, completely shuts off all fire communication between the chemical department in the first story and basement, and the natural history and cabinet rooms above. The window sashes are the only wood work exposed to fire from without, and the building is 76 feet distant from any other.

The internal arrangement of the building is in accordance with the experience of the best experts in the county.

The President of the College, Dr. Cummings, Professors Johnston and Rice, in company with Mr. Judd, and the architect, Mr. Rogers, visited the laboratories of Yale, Harvard, Columbia, Brown, and Amherst Colleges, and after consultation with the professors of these institutions, decided upon the details of construction, and the result has been the most complete museum and laboratory to be found in the county. Such a school cannot fail to greatly add to the usefulness of the Wesleyan University, and it is to be hoped that the alumni of the College, inspired by Mr. Judd's noble example, may be led to contribute the necessary funds towards founding the professorships required by an efficient department of natural history and technology.

SCIENTIFIC INTELLIGENCE.

TO DETECT LEAD IN DRINKING WATER.

Mr. Wm. H. Chandler, of the Columbia School of Mines, remarks, for the determination of small quantities of lead, to evaporate the water with about two fluid ounces of an acid solution of acetate of ammonia—this reagent prevents the séparation of the sulphate and carbonate of lead during evaporation. After concentration any iron and lime salts that may fall down can be removed by filtration. If any lead be present it can be precipitated in the usual way by sulphureted hydrogen, and may afterwards be converted into the sulphate of nitric and sulphuric acids.

ANALYSIS OF SUGAR CANE.

It is now universally conceded that plants obtain their mineral constituents from the soil, and what these constituents are can be accurately determined by chemical analysis. Unless the mineral matter removed by the crops be from time to time replaced, the soil will be exhausted, and no further produce can be raised upon it. On this account every new analysis of the ashes of corn, wheat, tobacco, or other crop, is of value, and M. Popp has rendered a service by examining different varieties of sugar cane in a more careful manner than has hitherto been done. He finds the fresh sugar cane stripped of its leaves to be composed as follows:

	America.	Middle Egypt.	Upper Egypt.
Water	72·22	72·05	72·13
Cane sugar	17·80	16·00	18·10
Glucose	0·28	2·30	0·25
Cellulose	9·30	9·30	9·10
Mineral salts	0·40	0·35	0·42
	100·00	100·00	100·00

The ashes of the American sugar cane and leaves showed the following composition.

	Ashes of sugar cane.	Ashes of the leaves.
Potash	7·66	10·65
Soda	6·45	3·26
Lime	12·53	8·19
Magnesia	6·31	2·45
Oxide of iron	0·56	0·85
Silica	43·75	65·78
Phosphoric acid	5·45	1·25
Sulphuric acid	16·53	2·18
Chlorine	0·21	1·65
Carbonic acid	0·00	3·55
	99·75	99·81

It would be easy to compute from these analyses the amount of potash, soda, silica, etc., removed by a tun of sugar cane, and also o ascertain what kind of soil is best adapted for the grow h of such a crop. The plant by its vital force is able to secrete carbon, oxygen, and hydrogen in just the proper proportions to form cellulose and sugar. It is certain that we can control the growth of the stalk by the abstraction or addition of mineral matter to the ground, it would be an equally important discovery if by some practical addition and subtraction of carbon, oxygen, and hydrogen, one could increase or diminish the percentage of sugar at will. In this age of synthesis such a discovery does not appear to be impossible, and we may some day have conservatories for the sugar cane into which gases can be pumped, and the yield of sugar be varied at will.

NEW SOURCES OF RUBIDIUM AND CAESIUM.

Mr. E. Sonstadt has found these rare metals in a number of new substances. If oxalate of ammonia be added in excess to sea water, and the well-washed precipitate ignited, moistened with nitric acid, and examined in the spectroscope, the *a* lines of rubidium and caesium will be distinctly visible in the spectroscope. The same water evaporated to dryness and examined in the usual way will show no trace of these lines, hence the value of testing with oxalate of ammonia previous to evaporation. The presence of the rare earths in sea weeds naturally follows after their detection in the salt water, and the author had no difficulty in finding them.

Various sea shells, and the lime obtained direct from sea water showed at once the rubidium and caesium lines, and the same is true of marine lime stones. The alkalies, rubidium and caesium can no longer be styled rare, since even in a few grammes of sea water they can be more easily recognized than bromine or iodine. The next point in the investigation is to ascertain to what useful purposes they can be applied.

PREPARATION OF BROMIDE OF SODIUM ON THE LARGE SCALE.

M. Castelhaz, a manufacturing chemist, states, in the first place, that, according to the communications received by him from several physicians who have applied bromide of sodium in their practice, instead of bromide of potassium, the efficacy of the former is far greater than that of the latter. As regards the preparation of this salt, the author says: "The best plan is to prepare first, bromide of ammonium, by causing bromine to fall drop by drop into dilute, but pure, liquid ammonia contained in a series of Wolff's bottles, in order thus to prevent the loss otherwise inevitably resulting from the volatilization of the products formed by the great heat disengaged on the bromine and ammonia uniting. The liquids, after saturation, are evaporated in a cast-iron retort, to which an earthenware receiver is fastened, wherein are collected the vapors of water, any excess of ammonia, and some bromide of ammonium, which is accidently carried over. The bromide of ammonium thus obtained is converted into bromide of sodium, by being mixed with pure carbonate of soda, and the application of sufficient heat to volatilize and sublime the carbonate of ammonia formed by the reaction. This mode of preparation yields after re-solution of the bromide in water, and evaporation similar to that used for chloride of sodium, perfectly pure and anhydrous bromide of sodium."—*Chemical News.*

NEW METHOD OF ESTIMATION OF GRAPE SUGAR.

Mr. K. Knapp's new method is based upon the fact that an alkaline solution of cyanide of mercury is completely reduced to the metallic state by grape sugar. The method is executed as follows: 10 grms. of pure and dry bicyanide of mercury are dissolved in pure distilled water; to this solution are added 100 c. c. of caustic soda solution (sp. gr., 1·145); and, next, as much distilled water is added as will be required to make a bulk of 1,000 c. c. A series of experiments made by the author brought to light the fact that 400 milligrms. of cyanide of mercury are, when in alkaline and boiling solution, completely reduced to metal by 100 milligrms. of pure grape sugar. The titration is done as in Fehling's method—40 c. c. of the alkaline cyanide solution are boiled in a porcelain basin; and the sugar solution (not stronger than about half a per cent) is added until all the mercury is precipitated. In order to test the course of the operation, a single small drop of the fluid is put upon a Swedish bit of filtering paper stretched over the mouth of a small beaker-glass, while the bottom of that glass is covered with rather strong sulphide of ammonium. As long as any cyanide remains undecomposed, a brownish spot will appear. The author states that, with a little practice, even 1·10th c. c. of the above dilute sugar solution can be readily estimated.—*Chemical News.*

METHOD FOR RENDERING WOOD DIFFICULTLY COMBUSTIBLE, AND FOR PRESERVING IT WHEN UNDERGROUND.

The wood, says Dr. Reinsch, which must not be planed, is placed for twenty-four hours in a liquid composed of 1 part of concentrated silicate of potassa and 3 parts of pure water. After having been removed from this liquid, and dried for several days, the wood is again soaked in this liquid, and, after having been again dried, painted over with a mixture of 1 part of cement and 4 parts of the liquid above alluded to. After the first coat of this paint is dry, the painting is repeated twice. Of the paint mixture alluded to, two large quantities should not be made up at once, because it rapidly becomes very dry and hard. Wood thus treated is rendered uninflammable, and does not decay underground.—*Chemical News.*

The Bloomfield, N. Y., Gas Well--Testing the Quality of the Light.

The possibility of obtaining, in many places, a supply of natural gas directly from the rocks, not only adequate in quality and quantity for illuminating purposes, but also as a fuel in its most perfect form for driving machinery on the grandest scale, seems about to be realized. The village of Fredonia, in this State, has been lighted chiefly with natural gas for many years. At Erie, Penn., twelve different gas wells are now pouring out their inexhaustible stream of gaseous fuel—one of them driving a large flouring mill, supplying the heat to the boilers, formerly obtained at the expense of ten tuns of coal daily, and furnishing, besides, all the light needed, while another well yields enough to propel the pumping engines of the city water works. Some of the wells at Erie have been in use for several years. Our readers are, no doubt, aware that the wonderful gas fountain in West Bloomfield, Ontario Co., which for the last five years has been an object of so much curiosity and scientific research, has more recently become a matter of importance as a most valuable source of light and heat, capable of being speedily utilized. The project of supplying Rochester with this gas is seriously entertained. About a year ago a company of the most respectable and wealthy gentlemen of Elmira purchased this property with a view of turning it to some valuable account.

To satisfy themselves of its true value and of the uses to which the gas might be most profitably applied, Prof. Lattimore was engaged by the company to make a scientific investigation of the chemical qualities of the gas, and also to ascertain the daily product. His investigations, which were commenced some weeks ago, at once indicated a gas of a high degree of purity, and especially free from those qualities which are so objectionable in ordinary coal gas. The volume of gas issuing daily from the well proved to be surprisingly great; it is enormous, far exceeding the quantity produced by any other well in the world. Prof. Lattimore has made a second visit to West Bloomfield this week, spending two days at the well for the purpose of completing his investigations. The illuminating quality of the gas—its candle power—was the special subject of investigation. This was determined by a series of most rigid experiments by means of the most delicate and highly improved photometrical apparatus known to gas engineers. These interesting tests were witnessed by a large number of the stockholders, all of whom expressed their delight and surprise at the unexpectedly favorable results obtained.

The Exposition of Textile Fabrics at Indianapolis.

The Indianapolis journals comment favorably upon the exhibition of textile fabrics now open in that city. From Ohio, Illinois, Iowa, Kentucky, Minnesota, Indiana, and other States manufacturers have come, bringing with them samples of cassimeres, tweeds, jeans, blankets, flannels, and other woolen fabrics that are all that can be desired. There are some lots of goods on exhibition which in point of excellence of material and finish excite the admiring comments of all who examine them. There are cassimeres and flannels that are just as good as can be manufactured abroad, and much better than nine-tenths of our own people believe can be made in our home mills. And yet it is done, and the people have not yet discovered of what great value our home manufactures are, and what an immense wealth they will shortly represent. These expositions of goods being daily manufactured, gotten up by the Woolen Manufacturers' Association are having the effect to make more generally known the worth and quality of the fabrics they make, and through their influence we predict that it will not be long until our citizens become aware of the fact that it is not necessary to import from the "old country" their cloths, cassimeres, flannels, etc., when they can get as good if not a better article of home manufacture. It is not long since that the manufacture of jeans and linsey in this country was considered the acme of cloth-making on this side of the Atlantic.

Not alone to woolen fabrics is this exposition confined, but from the far South, from South Carolina, Alabama, Georgia, and other Southern States, come manufacturers to exhibit what they are doing there in making cotton goods. We find on exhibition sheetings, shirtings, and drills that are as good as we get from the Eastern factories. This in itself shows that a new spirit of enterprise has found position in the hearts of our people.

How Icebergs are Formed.

Mr. Dunmore, the photographer who accompanied the Bradford art expedition last year to Greenland, publishes in the Philadelphia *Photographer* a very interesting description of the appearance of Greenland, its glaciers, etc. He says:

"The glacier comes moving slowly down from the mountains, a great river of ice, thousands of feet deep, sometimes ten miles wide, to the fiord or bay at the foot of the mountain. The Alpine glaciers roll down into the warm valleys, and there, warmed by the sun, melt away like a piece of wax before a candle, and form brooks and rivers. But in Greenland they cannot do that, it is too cold. Therefore, as the ice at the mouth of the glacier is pushed forward to the water's edge, it must break off in pieces and fall in; and such pieces are icebergs. When they break off, the glacier is said by the natives to 'calve,' or an 'iceberg is born.'

"I can give you no idea of what a beautiful sight it is to see an iceberg break off; but we, who have seen it, will never forget it. Think of a mass of ice as big as the space of ground covered by the city of Boston, falling into the sea, and of the tremendous crash that occurs when it breaks away from its fellows, and they give it a parting salute as they groan and growl their last farewell. Now see the waves leap up forty feet into the air, washing and lashing the glacier with spray, and sweeping everything away not strong enough to bear the shock; then watch the new-born berg as it rocks in the sea like a huge porpoise, up and down, dropping here and there portions of itself, which dive down and reappear in all directions, and you can imagine faintly what it is to see a glacier 'calve an iceberg.' It is a long time before the trouble of the waters ends, or before the new-born babe ceases to be rocked, and is still enough to have its picture made. It is a sight one never tires of.

"The next day our party started to go on top of the glacier. It was very hard to get on to with our cooking utensils and photographic traps, it was so very steep. We traveled six miles on the top of it. The sight was grand from there. It was about two miles wide, and the length of it we could not tell, as it was hundreds of miles. The depth of it was from five hundred to eight hundred feet. We made a few pictures, ate our dinner up there, and then started back."

A Mountain Railroad.

Mr. H. J. Kerr Porter thus describes in the London *Times* his ascent by the Rigi Railway: "A wagon laden with about a tun and a half of timber prepared for sleepers was ready, and on this twenty-five passengers took their seats, and we started, propelled by the engine, which is of peculiar construction. In twenty minutes we traversed 4,700 feet, and were about 1,170 feet above the level of the lake from which we had started. We found thirty-three men at work laying down sleepers and rails; the transverse sleepers are six inches wide by four inches; the ordinary rails are bolted to those sleepers, which are two feet apart, and at six inches outside the metal rails, longitudinal beams six inches by six inches are bolted to the sleepers; in the center a metal rail is firmly bolted, in which there are openings to receive the cogs of the center wheel of the engine, which revolves with the axle, the steam power being applied to a cog wheel on each side, at equal distance from the ordinary wheels and the center one above described; the brakes are applied to the ordinary wheels, which are like the wheels of any carriage, and are about two feet six inches in diameter. The boiler and furnace are not placed horizontally, as is usual, but stand upright, having while on a level, a considerable incline forward; when ascending the mountain the boiler is consequently quite perpendicular, and the floor of the tender perfectly level, the tender and engine being in one, and supported by the four small wheels, one of which I have described above.

Economy in Railway Management.

Economy, in its true sense, seems to be very imperfectly understood; at least those who undertake to practice it take widely different views in regard to what they consider economy. What some would consider economy would be called wasteful extravagance by others. There are many managers, with a reputation as first-class business men, who entertain false notions in regard to economy. Such are those who seem to consider economy to consist in hoarding every dollar they get hold of, and never paying one out until it is *absolutely necessary*—in fact, to hang on to it with the grip of a miser.

It is no economy to save a dollar if it costs five dollars to do it; yet there are many who practice this sort of saving and call it economy. Perhaps there are no more shrewd business men in the country, as a class, than our railroad managers; yet, although they are usually men of sound judgment, they frequently err in regard to the practice of economy.

It is the practice with many, on roads running through timbered portions of the country, where wood is the only fuel used, to purchase soft wood, as it can be had for considerably less per cord than hard wood. Of course they do not do this with the idea that a cord of soft wood will make as much steam as a cord of hard wood; but they fail to make correct estimates of the difference in the real value of hard and soft wood. Some very nicely conducted experiments have shown that soft wood is the most expensive compared with hard wood; that is to say, the difference in the price of the two kinds of wood is not in proportion to their steam-making qualities, the difference, as prices generally range, being in favor of hard wood. And even if this were not the case, it takes a much larger quantity of soft wood to perform the same amount of traffic, and of course the hauling is more expensive, and on many roads the same price is paid for sawing.

All things considered, the *cheap* wood is the most expensive. It would be well for the railroad community if the results of experiments testing the steam-making qualities of the different kinds of wood were published. Then a price could be established, taking certain kinds of hard wood as a basis, and in this way we would be sure at all times to get the full value of the money expended.

There is a great deal of "economy" practiced in the purchase of all kinds of railroad supplies, and in this matter the railroad men of the country have, to use a common expression, "beaten themselves." As soon as manufacturers discovered a disposition on the part of railroad men to get the cheapest article in market, they commenced the manufacture of inferior goods, and this has been practiced to such an extent that it has become a difficult matter to get a genuine article of any kind on the whole list of railroad supplies.

A few days since the writer passed over a railroad in one of the Western States, and happening to meet an old acquaintance who is an engineer on the road, he received and accepted an invitation to take a ride on the engine. As it was some minutes before his train was to leave we took a walk about the station. In the course of the walk he stopped suddenly and picked up a piece of broken link, which operation I noticed with considerable curiosity. He noticed that I watched him with some interest, and said, "What do you suppose I am going to do with this piece of old iron?" I remarked that I did not know, unless it was to save it. He smiled and said, "That was it exactly." He was going to put it on the tender where he had more old iron. He always made it a practice to pick up all the old iron that came in his way that he could handle easily, and when he had a quantity of it on his tender he would throw it off on to some convenient scrap heap. "In this way," said he, "I save tuns of old iron every year that would otherwise be lost. The boys laugh at me, but I don't care for that. "Now," he added, "the company I am running for are sadly in need of more passenger cars, and they are economizing in every possible manner to get means to pay for them. They cut down our wages and reduce the number of brakemen, run the shop short-handed, discharge men off the track, reduce the help at stations, and so on, all for the sake of saving money to buy rolling-stock, when there is property enough in the shape of car wheels, axles, track iron, old springs, and everything in that line lying along the line of the road to pay for a first-class passenger train. There is a place up here a few miles where a whole freight train was wrecked two years ago—thrown off the track by expansion of iron. Most of the running gear is there yet; some of the axles are bent, but I think some of them might be used again. I don't understand why they don't get this stuff together and convert it into cash. It would bring a pile. All along the line there is property of this kind which might be collected with very little expense, and I cannot understand why it is not done." "Yes," he continued, "they are always preaching economy, but they 'save at the vent and waste at the bung.' They measure the oil I use by drops, and furnish a cheap, miserable, nasty stuff at that; they know just how many sticks of wood I burn, and how many ounces of waste or old rags I use. This is all right enough; I find no fault with that. But then they will go and pile six hundred or a thousand dollars' worth of ornament on a locomotive, named after some nabob, and the fireman has to work day and night, and furnish his own emery and acid to keep her looking anyhow. There should be another brakeman on this train, but they can't afford it, although there is useless fancy work enough on this engine to pay a brakeman for a year and a half."

Time was up now, and as he pulled the throttle, he pointed to the tender, and said, with a smile, "There is some more economy—green wood."—*Railroad Gazette.*

DR. R. J. GATLING, the inventor of the celebrated Gatling gun, left for Europe on Saturday, the 6th inst., in the steamer *Italy*.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

A. B., of Pa.—It is impossible for us to infer from your letter the cause of the moldy smell pervading your Brussels carpet, as you state there is no dampness to account for it. A practical remedy for the trouble is equally hard to suggest that will not be attended with inconvenience or injury to the carpet. Most things that will destroy mold fungus will injure the colors. The best thing we can think of is carbolic acid, but that is difficult to apply uniformly in so small a quantity as would not also give rise to offensive odor. It is also questionable whether this substance would not affect some of the colors. Perhaps some of our correspondents, under whose notice this falls, may suggest something to help you.

D. L. R. of Ala.—The "anomaly" to which you refer, has been long understood and known, as you will find by reference to works which treat of friction. It generally takes more force to overcome the friction of a body starting from a state of rest, than to overcome the friction after it begins to move. It is supposed this fact is accounted for by the slight indentation of the bearing surfaces while at rest, which does not occur while they are in motion. We have, however, always considered the accuracy of this explanation as questionable.

L. H. B., of Pa., wants some one to invent something in the chemical way that will keep flies out of the house. He draws a most distressing picture of the sufferings of himself and his neighbors this season from these pests, which he says are more numerous than ever before. If he would employ screens, made of mosquito netting for doors and windows, we think he would find them all that he desires. They are very cheap, and we find them here perfectly effectual.

J. J. K., of Wis.—What is meant by fractional distillation is the separation of different volatile liquids from each other by distillation at different temperatures. The most volatile will pass off at certain degree of heat, when the heat is raised to, and maintained at a higher temperature the next in degree of volatility is distilled over, and so on.

J. T. C., of D. C.—The causes of boiler foaming may be classed in two categories. Impurities in the water used, and want of proper extent of water surface to allow the steam to be quietly liberated from the water. It is generally on this latter account that the upright boilers are more apt to foam than horizontal ones.

T. P. B., of Cal.—Zinc will not answer for the sheathing of wooden hulls, because it becomes covered with oxide, and does not maintain a clean, bright surface. When it is attached to the bottoms of iron vessels, however, it acts differently, galvanic action increasing the chemical action, and keeping its surface bright.

E. H., of Ill.—Electricity, when voltaic or frictional, is conducted by the entire thickness of the conductor. The same areas of cross section in conductors of the same materials, will give the same conducting power, no matter what may be the shapes of these cross sections.

H. C., of N. Y.—We do not believe the formation of the insoluble sulphide of lead by means of the use of sulphide of potassium will answer for the pipes of soda water fountains. We think the use of lead for pipes in these fountains should be prohibited unless they are lined with tin.

C. C. C., of Iowa.—We have no doubt that the plant you send us will work into good paper. There are many others that can be so utilized. The question concerning their use is simply one of economy in manufacture.

A. C. C., of Ohio.—Use shoemakers' wax as a preservative for twine that has to be used under water. Melt the wax, and soak the twine in it. Or, soak thoroughly in raw linseed oil, and allow it to dry thoroughly before use.

C. H. D., of N. Y.—No way of separating water from milk that will leave the nutritious ingredients fit for domestic use, has yet been discovered, except evaporation.

J. A., of Pa.—Your method of describing a square within another square, that shall equal one fifth of the larger square, is a well-known solution of an old geometrical problem.

D. C. L., of ——, wishes to learn of some cheap ingredient which, added to coal tar, will add to its drying properties on iron.

D. L. M., of Vt.—Oxygen is undoubtedly greater in quantity than any other elementary substance of our globe.

Facts for the Ladies.

I have used my Wheeler & Wilson Machine seven years without repairs and one needle for all kinds of family sewing for four years. It is the most valuable piece of furniture for me that could be purchased.

MRS. F. E. WILDER.

Hilton Head, S. C.

Business and Personal.

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