exaggerated theatrical moonlight effect, which is the most remarkable to a spectator outside, who, on a misty night, sees the long streams of ghostly light pouring through every opening of the building in pallid beams that, under favorable conditions, may be traced for above a quarter of a mile. I have seen them projected in bright disks upon the face of low clouds, and visible through the whole of their intermediate course.

When the flow of spiegeleisen has ceased, the trough is moved aside and a large counterpoised arm bearing the "ladle" is swung round upon a hydraulic piston, which forms at the same time its axis and lifter. The ladle, a large lined iron pot, is adjusted under the mouth of the converter, which is now tilted a little more, till the melted metal is poured out in a thick brilliant white-hot stream, accompanied from time to time with great slabs of cinder of a darker color, which float upon its surface as it pours, and form a thick scum covering the contents of the ladle. When all the fluid metal is poured into the ladle, the converter is tilted over till completely inverted, and the remaining viscous mass of cinder drops out in a glowing heap upon the floor.

During these proceedings a set of workmen have been preparing the molds in which the ingots of steel are to be cast. These molds are of cast iron, nearly cylindrical, being larger at bottom than top, and open at both ends. They have lugs or handles at top by which they are lifted. They stand upon a tile, and are well packed round the bottom with sand to prevent the outflow of the melted steel. While the blow was proceeding these were arranged in an arc of a circle whose radius exactly corresponds with the length of the arm bearing the ladle.

The ladle is now swung round and adjusted till it stands directly over the first of this row of iron vases, and a plug is released, by which a hole in the bottom of the ladle is opened. Through this the steel is poured into the ingot. When the first is filled, the plug is closed, the ladle swung round to the second mold, and so on, till all the steel is thus cast into ingots, the size of which varies with the kind of work for which the steel is required. A thin steel plate is placed on the top of each casting immediately the mold is filled, and over this a bed of sand is placed, and speedily and firmly pressed down.

As soon as the ingots have solidified, and while they are still glowing, the molds are lifted off them by means of a hydraulic crane, and afterwards the ingots are picked up by tongs attached to the same machinery, and are carted away, all red hot, to the hammer shops, where they are thumped and rolled or otherwise tortured into their required forms of rails, tires, and plates.

Japanning on Metal, Wood, and Paper.

Japanning on metal, wood, and paper is executed in much the same manner as similar works in spirit or oil varnishes, except that every coat of color or varnish is dried by placing the object in an oven or chamber called a stove, heated by flues to as high a temperature as can safely be employed without injuring the articles, or causing the varnish to blister or run. For ornamental works, the colors ordinarily employed by artists are used; they are ground in linseed oil or turpentine, and are afterwards brought to a proper consistence for working by mixing them with copal or anime varnish. The latter is generally used, as it dries quicker, and is less expensive than the copal varnish.

For black japanned works, the ground is first prepared with a coating of black, made by mixing drop ivory black to a proper consistence with dark-colored anime varnish, as this gives a blacker surface than would be produced by the japan alone. The object is then dried in the stove, three or four coats of japan are afterwards applied, and the work is dried in the stove between every coat. If the surface is required to be polished, as for the best works, five or six coats of japan are necessary, to give sufficient body to prevent the japan being rubbed through in the polishing.

For brown japanned works, the clear japan alone is used as the ground, or umber is mixed with the japan to give the required tint, and the work is afterwards dried in the oven, in the same manner as black japan.

For colored works no japan is used, but they are painted with the ordinary painters' colors, ground with linseed oil or turpentine, and mixed with anime varnish; and the work is dried in the oven in the same manner as the black japan.

To protect the colors, and give brilliancy and durability to the surface, the work is afterwards varnished with copal or anime varnish, made without driers. Two or three coats of varnish suffice for ordinary works, and five or six for the best works that are polished. Very pale varnish is of course required for light colors.

Ornamental devices are painted on the objects in the usual manner, after the general color of the ground has been laid on. The colors are dried in the stove, and the work is finally varnished and polished just the same as plain colors, but more carefully.

Metal works require no other preparation than cleaning with turpentine, to free them from grease or oil, unless the latter should happen to be linseed oil, in which case the cleaning is generally dispensed with, and the articles are placed in the stove and heated until the oil is baked quite hard.

Wood that is intended to be used for the best japanned work, requires to be thoroughly well dried before it is made up, or otherwise it will be subject to all the evils of shrinking, warping, and splitting, when exposed to the heat of the stove. To avoid these evils, the wood, after having been well seasoned in the usual manner, by exposure to the air, is sawn out nearly to the required forms, and baked for several days in the japanner's stove, the heat of which is gradually increased; and the wood is afterwards worked up into chairs, tables, trays, and similar articles, which are afterwards again exposed to the heat of the stove, and any cracks or other imperfections, that may be thus rendered apparent, are carefully stopped with putty, or white lead, before the japanning is commenced.—*Handbook for the Artisan, Mechanic and Engineer.*

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

The Destructive Action of Albumen--Its Remedy

MESSRS. EDITORS:—On page 81 of your valuable journal, the question is asked: What is the secret of making black (carbon) ink free from any disintegrating or perishing ingredients? Permit me to answer the question, not only in relation to black carbon ink, but to many other materials that labor under the same or similar difficulties.

The carbon in the black ink is not subject to decomposition, but some of the ingredients added to it are; these ingredients are not free from albuminous matter, hence the decomposition. It certainly is singular that cause and cure should have remained a secret until recently; but the fact has been satisfactorily proved at last, that all crude organic substances contain albuminous matter.

Animal organism takes the albumen ready formed into its nourishment, but vegetable organisms cannot, of itself, assimilate the albumen; out of its constituents, the vegetable albumen is formed in the system of the plant, in which it appears invariably combined with glutin and other substances, as vegetable gluten. (This, by the way, may be the true definition of animal and vegetable organism.)

Albumen is a necessary part in all organism, which cannot form or exist without it or its constituents. But life having ceased, the nitrogenous albuminous parts are the true basis of decomposition under ordinary elementary exposure, by their superior tendency to oxidize and to give support to microscopic organism, whose presence involves the several states of decomposition, termed fermentation, putrefaction, and decay. As the presence of microdermic organism and the albumen required for its nourishment are necessary conditions for elementary decomposition, an easy conclusion leads us to the essential condition of stability: the removal of the albuminous matter, which forms the support of destructive organism.

Albumen is a colorless substance, soluble in water. Animal and vegetable albumen are identical; they differ in the association in which they appear, and in the superior tenacity of the vegetable compound to maintain the association.

An erroneous statement, which we meet in all books on the subject, requires correction, as it leads to the incorrect conclusion that albumen may be removed, from liquids, in a coagulated state by mere heating. Crude animal albumen readily coagulates at about 160° Fah.; the erroneous conclusion is drawn that *all* albumen thus coagulates. Vegetable albumen in the form of gluten requires other conditions than mere heat for a separation preliminary to a coagulation. Simply boiling heat, continued for many hours, only produces a partial removal of the albumen from vegetable juices or extracts; for instance, saccharine or oleaginous juices of any kind, such as beerwort, the saccharine extract from malt. However, other agencies assist the coagulation of the albuminous parts at lower temperatures, even little above 32° Fah.

The very nature of the albuminous compounds, and that they form the basis of all elementary destruction of organic substances, being unrecognized, all operations with these substances remained something like empirical attempts to accomplish a resistance against unknown agencies, and the manufacturing operations improved slowly. A recognition of the all-governing principle in organic matter permits the deduction of the proper mode of treatment.

The agent, by which the albumen can be separated and removed from any crude organic substance, without injury to the other compounds, or by which it can be retained in an innocuous condition, is the air we breathe.

Intelligently applied, it enables us to meet all the difficulties successfully. Rapid passage of air through liquids or over an organic substance produces traces of ozone, that is, oxygen in an excited, highly active condition. (Ozone is produced in large quantity by electric action, by blowing of air through a flame, etc.) Want of ozone in air is destructive to dead organic matter, the slow access or quiescent contact of air favors putrefaction; rapidly-moving (ozonized) air, on the contrary, destroys the organism which causes putrefaction. It seems to act also essentially upon the albuminous matter, separating it from its compounds, and, by coagulating it, to render it innocuous. At a temperature favorable to an alcoholic or curing fermentation, this process is at the same time improved, by invigorating the mycoderms, to whose flourishing condition the fermentation is due. As soon, however, as the albuminous parts are entirely coagulated, the mycodermic action must necessarily cease for want of the required aliment, the soluble albumen.

Every part of a fluid, or of solids immersed in fluids, is uniformly acted upon, by impelling the active gas in a divided state through the fluid, in which a mechanical commotion with the chemical action is produced; or, the air or gases are made to circulate, freely and rapidly, about solid substances whose preservation is intended.

Mycodermic life is suppressed in vegetable matter, at a temperature above about 135°. The albuminous parts may thus be eliminated from vegetable fluids, with exclusion of fermentation, by currents of air through the fluid, heated above 135°; the action is more vigorous at a still higher temperature, and the action, of the atmospheric oxygen or other gases, greatly intensified at a higher than the ordinary atmospheric pressure.

No chemical can prove of universal use for purification; what improves one injures other organic substances, while air, the principal source of all organism, benefits all alike. The practical application, in the manner explained, of the universal principle, is termed, by the Californian discoverer of both, the d'Heureuse's Patent Air Treatment, and the fact that the application is patented cannot detract from the truth of the principle involved. It appears to be of universal applicability in the manufacture of sugars, oils, glue, gums, wine, cider, beer, spirits, and in the preservation of meat, produce, hides, etc. It certainly is simple, effectual, and subject to the control and comprehension of the most ordinary intellect.

The ingredients for black carbon ink are generally crude gums, or other crude organic matters, not free from albuminous parts, and decomposition of the whole compound takes place of necessity. R. D'HEUREUSE.

New York city.

Sirups.

MESSRS. EDITORS:—The explanation of Prof. Chandler, as recently quoted in the SCIENTIFIC AMERICAN, of the formation of sirups from refined sugars, I do not dispute. Such sirups are what they should be. I venture to assert they will not blacken the teeth. But the "golden sirup" made from starch and sulphuric acid is an imitation of these. That iron should necessarily occur in glucose sirup, is not true; but I contend that all I have examined did contain it, which I suppose was caused by the long continued action of the acid, upon the iron vessels in which the sirup is made, forming a solution of sulphate of iron (common copperas). When the manufacturers use other material, the test for iron may prove useless. Troemner's test for glucose can then be used. I don't wish to be understood as condemning glucose sirup. My purpose is only to give, to those who prefer cane sirup, the opportunity of distinguishing it. If the drippings of cane sugar contain iron, the sugar would exhibit like characteristics. I have applied the test for iron to cane sugar and molasses, and found none. The action of boiling cane juice, neutralized as it is by lime, has little effect on the kettles, as tests show. Under the circumstances, I say cane sirup, as now made on plantations in Louisiana, does not contain iron to an appreciable extent, blacken the teeth, or produce a burning sensation in the stomach, and that which does may fairly be supposed something else.

New Orleans. JOHN H. POPE.

Coal-Cutting Machine Wanted.

MESSRS. EDITORS:—The interest you take in improvements induces me to call your attention to the question whether machinery, or mechanical appliances, that will facilitate the mining of coal, thereby rendering operators less dependent on the miner, and relieving the consumer of coal from the high prices and fluctuations in consequence of strikes, cannot be invented. Now is a good time to call attention to a question of this kind, when 100,000 miners are on a strike, for no good cause, paralyzing all branches of manufactures that use coal for fuel.

I am operating in the Block coal field, of Clay county, Indiana. The vein of this coal is from three to five feet thick, and there are seams running through the vein every twelve to twenty-four inches, that make it very easy to mine. No blasting is necessary in this coal. All the miner has to do is to make a bearing-in with his pick, at the bottom of the vein, of from eighteen to thirty-six inches, when the coal is easily split out with wedges, the seams making this easy to do. If a machine were invented that would do this bearing-in, one miner could do the work of four or five. This would not reduce the demand for labor, as the demand for this Block coal is ten times ahead of the supply, as all the railroads that can get it are using it in preference to wood.

The inventor who constructs a machine that will mine this coal can make a good thing out of it, as every operator will want one or more for every room he has opened.

Indianapolis, Ind. J. R. ELDER.

[Patents have been taken for machines for mining coal, but we have not heard of their being introduced.—EDS.

Motive Power for Western Farmers.

MESSRS. EDITORS:—On page 49, current volume, of the SCIENTIFIC AMERICAN, is an article headed "Another Motive Power," which has set me to thinking that the new motor might be used more extensively than you there intimated.

The farmers of the great western plains are sadly in need of a new motive power. Agriculture has taken the first rank among all human pursuits; yet the farmer of the nineteenth century, the age of steam and telegraphy, plods along as his ancestors did, two thousand years ago, relying on the same forces, with this difference only: the modern farmer uses improved machinery.

But all machines require the application of force to make them move; and the only force at the command of the ordinary farmer, animal power, is expensive and inadequate. Put the farmer in possession of such a power as he demands, cheap and efficient, and we shall see as great a revolution in agriculture as has followed the introduction of steam to commerce and manufactures.

If compressed air can be made as efficient a power as steam, I propose that the farmer erect windmills to compress reservoirs of air, from which he could draw supplies to work engines, to draw his plows, cultivators, and reaping machines, to drive his threshing machine and corn sheller, as well as to grind his tools, churn his butter, and wash his clothes.

Windmills are easily and cheaply constructed, and, if it would not require cumbersome or expensive apparatus to compress the air and transmit its power to the various machines, I do not see why it should not almost entirely supersede animal power on the farm.

Wind is a variable power, and some may object to its use on this account; but there are rarely more than two consecutive days in which the wind would not produce the requisite force; and if sufficient power could be stored up to run the machinery of the farm during these days, this objection would wholly disappear. SAMUEL GRAY.

Homer, Ill.

Motive Powers--The Expansion of Gases, versus that of Fluids.

MESSRS. EDITORS:—Heretofore gases have been chiefly employed to utilize the expansive force of heat. Gases are elastic and compressible; fluids are—water, at least, is—nearly incompressible. Gases expand with a force in proportion to the increment of heat; water, with a force equal to its power of resisting compression—*i.e.*, the same increment of heat that would expand a volume of water in the open air, would expand it under any pressure, and doing any amount of work. Apply heat to water, and it will burst the strongest vessel you can put it into. Why will it not move the most heavily loaded piston you can apply it to? It will: but it is objected that the motion is too slow, and not powerful enough to be available. Let us see. Eight thousand and odd feet of inch copper pipe can be coiled in a jacket 6 feet × 6, without having the pipe nearer anywhere than half an inch, and leave a core in the center. Let the pipe be filled with water; the temperature can easily be varied, one half of the number of degrees between the freezing and boiling points, by filling the jacket alternately with steam and cold water. This I know by experience. This gives an expansion of $\frac{1}{48}$ of the bulk at the minimum temperature, or enough to fill a cylinder 3 by 12 inches 20 times; and this operation can be repeated once a minute, or oftener, if necessary. Now, a piston rod of 3 inch steel fitted to this cylinder, without a follower (the pressure exerted only on the outward stroke, against the end of the piston rod) would transmit 150 horse power, while the steam (at saturation) required to fill the jacket once a minute would not be so much as whistles through a 25 horse power engine every revolution. A continuous motion is secured by having two such apparatus, one contracting and furnishing a vacuum to exhaust into, while the other is expanding, and doing the work, and *vice versa*. Now, I repeat, *the same heat that will expand that water in the open air will make it exert one or one thousand horse power, according to the strength of materials.* I have produced over 600 pounds pressure in a small experimental tube 100 feet long, by simply pouring hot water into the jacket.

I have not the means to experiment on a large scale, or to introduce my motor to the public; hence this article. I will give any particulars, and show plans and specifications to any one who will furnish means to do so. F. SHAW.

Cordova, Ill.

Improvement in Mowing Machines.

MESSRS. EDITORS:—I have located a grass line for the mowing machine, and have made an improvement in the cutting point, the object of which is to prevent the blades from choking, a great drawback in harvesters. Choking is caused by the blades entering too far into the grass, or grain, when the cut is made. In very thick or wet grass, or grain, the blades slip over the grass, and draw it into the inside of the guards, which clogs the machine down, and stops the team. The operator is then obliged to pull the grass out with his hands, before starting again. This improvement will apply to all fashions of wheels and gearing. In all machines there are four gear wheels, two spur wheels, and two bevel wheels. Some have too many cogs, and some not enough. My grass line I fix at one fourth of an inch before the blades are full.

The following wheels and gear will cut at or before it reaches this line: Spur wheel, 62 cogs; its pinion, 11 cogs; bevel wheel, 44 cogs; its pinion, 11 cogs; total, 128 cogs.

This arrangement of gear and number of cogs will produce the result of the grass line I have described, and will work anywhere without choking. LABAN PERDEW.

Galion, Ohio.

How to Keep a Churn from Frothing Over.

MESSRS. EDITORS:—Happening one day to visit the house of a friend who kept a cow and made butter, I there saw a simple method he used to overcome the great trouble of all butter makers using the old-fashioned upright churn, viz: the overflowing of the cream during the process of churning. His plan was as follows: Take the body of the churn and cut a groove around the inside of the mouth, about three inches from the top and three eighths of an inch deep, and then remove half the thickness of the wood, making a shoulder all around; then take the cover and cut it to fit nicely inside, and you have now done away with all the old nuisances of cloths, tubs, pans, etc., heretofore required to save the cream that flowed over. Any man, almost, can do this, or the churn may be taken to a carpenter and treated for a few cents. Many an idea of less consequence than this, is patented, but all may take this one for what I gave for it.

W. A. MACKENZIE.

Eastport, Me.

A CORRESPONDENT informs us that apples may be kept from decay by covering them with dry ashes, a method easily tried, and if found satisfactory, capable of extensive application.

INTERESTING SCHOOL STATISTICS.

[CHIEFLY FROM MR. KIDDLE'S ANNUAL REPORT.]

There are, in New York city, 271 schools of all classes, attended by 102,608 pupils. The percentage of absentees in the boys grammar schools is $11\frac{1}{2}$, and in the girls, 14, showing that the boys are more regular in attendance than the girls. The pupils of the colored schools are far more irregular, the percentage of absentees being 35.

Allowing 100 cubic feet of space for each pupil in the grammar schools and 80 in the primary, it appears that the school buildings in New York afford accommodations for 99,437 pupils; but owing to changes in population, some of the school buildings are situated in neighborhoods where the attendance is necessarily small, while a few others have 3,000 more than they ought properly to receive.

In the matter of discipline, 88 per cent of the girls' schools and 64 per cent of the boys' are excellent. In reading, 63 per cent of the girls' schools are excellent, and 28 per cent of the boys'. In spelling, the girls are 42 per cent excellent and the boys 27 per cent. In writing, girls 60 per cent, boys, 36 per cent. In arithmetic, girls 30 per cent, boys, 24 per cent. It thus appears that the girl schools are in every way superior to the boys.

The number of teachers in all the schools is 2,683, of whom 363 are males and 2,320 are females.

The appropriation on account of salaries for 1871 is $1,690,000, which affords an average of nearly $630 for each teacher —or $16 a year for each child instructed; but as the total expenditures of the Board of Education are $2,626,000, it will be seen that the cost to educate one child is something over $26 per annum. The average number of pupils per teacher is 38, but in some of the primary schools, we have seen classes numbering nearly 100.

It costs $83,000 per annum to heat the school buildings, and $105,000 to pay the janitors.

Keeping pianofortes in repair is a matter of $2,500, and the Board of Education want for advertising and printing, the snug sum of $36,000.

Two hundred and eighty-seven boys and girls were banished from our schools during the year as incorrigible, out of 100,000 in attendance. This number is large of itself, but is a small percentage of the whole number, and speaks well for the power of "moral suasion," which is all the teachers have to rely upon since the abolition of corporal punishment.

It appears that 21,912 persons attend the evening schools, of whom 3,846 are over 21 years of age; 15,423 are males, 6,023 are females, and 466 colored of both sexes.

The most extraordinary information of all is in relation to the instruction in the natural sciences. Botany is taught without books or plants; Mineralogy without specimens; Physiology without charts, and Natural History with no means whatsoever for illustration. Some of the teachers have extemporized for themselves limited collections, and the pupils, in self-defense, have brought such odds and ends as they have been able to procure at home or on the streets; but that the great city of New York should be so utterly destitute of everything relating to the study of the natural sciences is an unspeakable disgrace, as inexcusable as it is disgraceful, and we trust that the recommendation of the Superintendent of Public Schools, on this important subject will be carefully heeded by the Board of Education, and that the evil complained of will be fully remedied before another year.

The Honey Trade.

This article, which, twenty-five years ago, formed quite an insignificant article of trade in this country, is rapidly increasing year after year in domestic production; whilst the amount imported is growing smaller.

In 1860 the total product of honey of the United States reported, was 23,366,357 pounds. New York stood at the head of the list, with 2,369,751 pounds, followed in order by North Carolina, 2,055,969 pounds; Kentucky, 1,768,692 pounds; Missouri, 1,585,983 pounds; Tennessee, 1,519,390 pounds; Ohio, 1,459,601 pounds; Virginia, 1,431,591 pounds; Pennsylvania, 1,402,128 pounds; Illinois, 1,346,803 pounds, and Indiana, 1,224,489 pounds; all other States falling below 1,000,000 pounds. In the winter of 1868-69, the Department of Agriculture sent out circulars, to known apiarians in most of the States, and received returns from 489 counties in 32 States. The aggregate number of hives reported was 722,385. Estimating for counties not reporting, and making due allowance for the fact that many of the counties reporting were giving special attention to bee culture, 2,000,000 of hives were deemed as low a figure as the returns would warrant. Allowing fifteen pounds of surplus honey to the hive (about two-thirds of the average reported), the total product in 1868 would be 30,000,000 pounds, which, at an average valuation of $22\frac{1}{2}$ cents per pound, would give $6,750,000. When we consider that the cost of production is merely nominal, it will be seen that it pays to keep bees.

Men of Progress.

O. E. Garrison, civil engineer, St. Cloud, Minn., writes; "It is with pleasure that I acknowledge the receipt of the splendid steel engraving, "Men of Progress." I desire to say that in my judgment the men there portrayed have done more real good to the world than all the warriors, conquerors, generals, and kings, ancient or modern, history has given an account of."

M. S. Sharpe, Pendleton, S. C. writes: "The papers and engraving came to hand all right. The engraving far surpassed my utmost expectations, and Mr. A. J. Sitton, to whom the credit for getting up a club is due, expresses himself highly pleased."

History of Railroad Cars.

Of the cars constructed between the years 1826 and 1850, we may first notice those made in 1830, and placed upon the Liverpool & Manchester (England) Railway. These cars had four wheels, but no springs, the bodies consisting of sills, to which the journal boxes were bolted and upon which the floors were laid. From the sills, stakes or posts arose, to which pieces of wood were attached, some longitudinally and some vertically; and these cars were formed without roofs, they being similar to those now used, and termed "rack-cars." In 1831, in October, one Mr. Joseph Knight proposed to employ springs under all cars, to support the body of the car and contents thereof. Mr. Knight also suggested an improvement in car wheels which entitles him to be ranked as among those who have excited our wonder, and who, by the exercise of his genius, has, more than most others, contributed to the successful operation of railroad cars. The improvement suggested at this time was that the treads of car wheels should be made conical, for the purpose of facilitating their passage around the curves of the road. How important this suggestion was all now fully realize, and it is not regarded as saying too much that up to this time no more important improvement, which has referred to railroad cars, has been made in this or any other country.

In 1869, cars for the transportation of passengers in England and Scotland consisted of three classes, the first class being well finished and provided with seats for the passengers to sit upon, which seats were furnished with cushions. The second class were of plain finish, without cushions or ornaments. The third class were little more than plain boxes set upon wheels and supplied with seats, but in many cases had no roof. In addition to these three classes, there were what were termed "mixed carriages," which were designated by names, and consisted of three compartments, the center one being for first-class passengers, and the two end ones for second-class passengers.

The next novelty which will be mentioned in the way of passenger cars was introduced in the year 1847, by a Mr. Hanson, of England, and consisted of a compartment car, the body of which was iron, and constructed as follows: In each of the partitions there was placed a hoop of iron, which was bound together by two cross stays, one of which connected the roof to the floor. To this frame-work a sheet or sheets of iron were riveted, a sheet of felt being placed between the heads of the rivets and the sheets of metal. These cars had only one seat in each compartment, it being so arranged that the faces of the occupants could always be in the direction in which the car was moving. At the bottom of the car there were arranged boards for resting the feet upon, which consisted of an upper and under piece, with a space between the two into which to thrust the feet, the inner surfaces being covered with sheepskin with the wool on it, the object being to provide for keeping the feet of the passenger warm during the time of his occupying the seat. At about the hight of the faces of the passengers there was placed a headboard or cushion, formed of sponge, and covered with leather or cloth, so that in the event of any sudden shock upon the cars, the head of the occupant would be brought in contact with the cushion, and thus, to some extent, be saved from injury.

A freight car, introduced at the same time and by the same inventor, was of the same general construction, except that its interior was arranged for the reception of freight, and a portion of its roof was made to slide upon rods over or under the fixed portion, the object being to provide for the reception and discharge of the goods through the roof of the car.

In the same year, 1847, a very decided novelty in the shape of a car wheel made its appearance in England, which consisted of a wrought iron wheel, which was made in sections, a portion of the hub and rim comprising each section, and parts being joined together by means of tongues and grooves formed thereon as the sections were made, and each being provided with a projection upon the outer segmental surfaces to enter a groove formed in the entire surface of the tire. The hole in the hub of the wheel for the reception of the axle was bored larger than the axle, so as to leave room for the insertion of an expanding ring, the insertion of which was to fit the axle, while its exterior was conical in form, so that, as it was forced inward, the segments would be forced outward, and thus tightened within the tire, the cone being held in place by a ring, which was cast in two parts, and placed in a groove turned in the axle.

At about the time of the last-named date, in contracting for the passenger cars to be run upon the road leading from Strasbourg to Basle, in France, it was stipulated that the roofs, partitions, and seats were to be made of American pine, three fourths of an inch in thickness, and that the roofs were to be covered with three pieces of leather, weighing at least thirty-eight pounds each.—*National Car Builder.*

EXCAVATION AND EMBANKMENT TABLES—ADDENDUM.— In connection with the article under this heading, on page 103, the following should have been included:

"The foregoing is on the basis of the slopes being $1\frac{1}{2}$ horizontal to 1 vertical, and the constant number to be added must be increased or diminished, as the slope is flatter or steeper, at the rate of 27 for every half foot increase or decrease in the horizontal designation of the slope."

EVERY time a shot is fired from Krupp's 1,000 pounder, it costs the Prussian government 800 thalers ($600), and the monster of a gun itself has cost more than would keep an infantry regiment for a whole year.

OBJECTS seventy-two feet long can be distinctly seen on the surface of the moon by the great telescope of the Earl of Rosse.