Correspondence.

Bread Alcohol.

To the Editor of the Scientific American:

Referring to No. 2, c. s., of your esteemed paper, Mr. N. D. Portland wrongs the "Brandy Bread Company." Any bread, the dough of which is only affected by saccharine fermentation, might prove sweet, there is no doubt, but the average human stomach could not stand such food. Even the "vinous" part of that mysterious process of fermentation is an act of importance to the bread. One part of the sugar must be decomposed, giving alcohol and carbonic acid, the development and expansion of which raise the dough and give it a sponge-like appearance and structure. As this process is going on until stopped by the heat of the oven, it is evident that a certain quantity of said ingredients escape through the chimney. Whether the quantity of escaping alcohol is sufficient to pay the expenses of condensation and refinery is a matter of experience.

JOSEPH HAMPL, Troop L, 8th Cavalry.

Fort Clark, Texas, January 25, 1884.

Movements of Cyclones.

To the Editor of the Scientific American:

In July, 1868, with other residents of State Center, Iowa, I witnessed the progress of a cyclone. There had been an extraordinary fall of rain from 1 o'clock P.M. to 2 o'clock P.M., which, stopping suddenly, business men came out doors, and their attention was called to a water spout in the southern heavens. When first seen it was south, about 50° above the horizon, cone shaped, base up, 3° to 5° in height, black and forbidding, rotary motion discernible and of fearful velocity, progressive motion from southwest to northeast. It disappeared behind a cloud about east, and was visible about ten minutes. During its progress it careened like a balloon as if top heavy. Part of the time it was a truncated cone, and then at the smaller and lower base it would lengthen out to a point, and once to an attenuation that twisted and whipped around like a rope. Its nearest approach to State Center was judged to be six miles, probably too much, as that distance would require a progressive motion of a mile per minute. It seemed to follow the irregular margin of a light colored bank of cloud lying beyond and below a darker, heavier, and higher bank.

I have since been on the tracks of several hurricanes—the Camanche hurricane which started at Camanche, Iowa, and traversed Whiteside and Lee Counties, Illinois; another was a cyclone of tropic proportions, that swept the sugar plantations of Louisiana, particularly Bayous, Tiche and La Tourche. Two in the floor-like bottom of the Mississippi in Tennessee, where the tangled masses of felled timber, ten to fifty rods wide, and miles long, are known as hurricanes. Another at Ripley, Tennessee, I was in; another at Brown's Island, in the Upper Ohio; and lastly, one at Gumtown, Warren County, Ohio. In each case I have taken some pains to observe and to learn from witnesses the habits of this violent phenomenon. In every case they harmonize with the general features as given in the books, the water spout of State Center being a miniature of each. All, with one exception, confirm the "Practical Hints Regarding Tornadoes," by John D. Parker, as in your issue of November 17, 1883. The exception is the cyclone of Louisiana, which was so large that several hours elapsed while the calm center was passing. At Baldwin, old brick sugar mills that withstood the first storm yielded like potter's clay to the second, and a guard that would have been theoretically right as against the first would have been exactly wrong for the second.

JOHN B. HOLBROOK.

Lebanon, Ohio, February 4, 1884.

Skillful Surgery.

Bruno Knorr shot himself, in this city, on the 24th ult., the bullet, of 32 caliber, piercing his skull just on the central line between the eyes. Dr. W. F. Fluher, one of the consulting surgeons of Bellevue Hospital, and Dr. Robert P. Morris, the house surgeon, probed for the bullet, and found that it had passed through the brain, taking a course slightly upward and to the left. It was impossible to remove the bullet by the way which it had entered, and Dr. Fluher decided that the best thing to do was to cut a hole through the skull at the back of the head where the bullet was lodged, and get it out that way. The difficulty was in determining the exact location of the bullet. Dr. Fluher, by means of the probe, got the general direction that the ball had taken, and formed his judgment by it. The hair was cut from the back of Knorr's head, and a hole the size of a cent was cut through the skull. The instrument used was a trephine, which is a cylindrical saw with a handle like that of a gimlet. It was placed against the skull and worked round and round until a circular hole was cut. The bullet was removed through this hole. A rubber drainage tube was then passed through the brain, its ends projecting an inch through the hole cut by the bullet and an inch through the hole made by the trephine. The operation, which was witnessed by nearly the whole staff of the hospital, lasted four hours. On the following Saturday and Sunday the patient was stupid and partially unconscious, but at times he gave monosyllabic answers to questions. Monday he was much brighter, and could talk and feed himself. His right arm seems to be paralyzed. Hopes are entertained of his ultimate recovery.

German Parcel Post.

In respect to the transmission of parcels the German postal service far surpasses that of most other nations, and an enormous business is done in this way by the post office department. Packages of less than 10 pounds weight are carried everywhere for 12 cents, including delivery at the house of the consignee. It is amusing to find that the establishment of this convenient system has fostered the growth of a large business in certain products, those particularly noted being butter and smoked herrings. Butter is now put up for this sort of transportation of 10 pound cases, of which immense numbers are sent from North Germany to the cities; and boxes of herrings of the same weight are constantly forwarded from the sea coast towns to the interior. Last year the number of boxes of herrings passing through the mail was more than 450,000, and it is said that the fishing villages of the coast appear to be on fire from the smoke of the little fires over which each fisherman cures his herrings for this convenient market.

The business of the poor fishermen is still further aided by an arrangement under which the sender of the box, on payment of a commission of 2 per cent, can receive at once from his postmaster, in cash, the value of his consignment, the post office department taking upon itself the risk of making collections on the arrival of the package at its destination.

Arsenic in Carpets and other Fabrics.

BY DR. F. ELSNER.

There is rarely any difficulty about the detection of arsenic in poisonous fabrics, for it is generally present in such quantities that it will not escape the notice of even an inexperienced young chemist. In many cases the quantity can be judged of approximately by Bettendorf's reaction. This is performed as follows: A weighed portion is dissolved in concentrated hydrochloric acid, free from arsenic, or, if insoluble, is extracted with this acid. As much stannous chloride as will lie on a knife blade is put into the boiling solution, and the reduction of the metal or the browning of the solution carefully noted, both as regards time and intensity. A parallel experiment is made with the tin salt and acid by adding at intervals from one to ten drops of an arsenical solution of known strength (say 1 in 1000 or 1 in 100). A little experience will make it easy to judge of the quantity of the arsenic approximately. This method is not intended to take the place of more exact methods, but only to obtain some idea of the subject, and as an assistance in subsequent analysis in the usual way.

It is much more difficult to detect arsenic is carpets and colored fabrics generally, where it is frequently present only in very minute quantities. In this case a qualitative test is *never* sufficient, even applied to a very small surface. In quantitative tests it is necessary to always work with the same quantity of reagents free from arsenic and with a convenient solution of the substance.

For many years I have been using a pure 25 per cent sulphuric acid, which penetrates all fabrics in 12 to 24 hours, at 130° to 150° Fahr., to such an extent as to remove and dissolve all poisonous arsenical compounds. If necessary, Prof. Fleck strengthens the acid by adding some nitric acid—about 3 or 5 per cent of acid with a specific gravity of 1·24. Of course this necessitates an evaporation of the solution until heavy fumes of sulphurous acid appear, so as to expel all the nitric acid before it can be put in a Marsh apparatus.

The rest of the operation, as described recently by Fleck (*Repertorium Anal. Chem.*), is so simple and elegant as to justify our giving it in his own words:

"Before beginning the operation 200 grammes of the 25 per cent acid is tested with 10 grammes of granulated zinc in a Marsh apparatus, putting in a strip of platinum foil. Another experiment is made by evaporating 10 grammes of the nitric acid with 100 grammes of pure sulphuric acid, and testing it in a Marsh apparatus. The reagents are comparatively pure if no mirror is formed on heating the delivery tube—which should be of hard glass and 2 millimeters in diameter—for half an hour, while the current of gas does not exceed 200 c. c. in 3 minutes. After being satisfied of the purity of the reagents, the article to be tested is exposed for 18 or 24 hours to the action of 50 or 100 c. c. of the sulphuric acid, then filtered, the residue washed, and the filtrate evaporated, if nitric acid was used, until this acid is all expelled in a porcelain dish; otherwise evaporation is not necessary, and the liquid can be made up to 200 c. c. At the same time a Marsh apparatus is prepared, and into it is put 10 grammes of zinc that has been tested and 20 c. c. of the solution just obtained. The gas is passed through a red hot tube, after the usual precaution, to avoid explosion, for half an hour, and if an arsenic mirror is seen, then the remaining 180 c. c. of the solution are preserved for quantitative tests. If none is observed, 20 c. c. more is added and the heating continued another half hour; this being repeated with each 20 c. c. until it is either all used up or the mirror appears.

"These qualitative tests will prove whether a quantitative estimation is possible or not. If the mirror first makes its appearance when 100 c. c. of the solution has been used, the quantity will be represented by tenths of milligrammes, and its estimation is almost impossible. But if a mirror is distinctly visible in 10 minutes after the first 20 or 30 c. c. are put in, it is safe to attempt a quantitative analysis.

"This is made as follows: The arsenic is precipitated *hot* with sulphydric acid gas, the precipitate collected on a filter, and dried in the air. It is then moistened with alcohol and the sulphur washed out with carbon-disulphide, after which it is dissolved in ammonia, reprecipitated with pure sulphuric acid, collected on a tared filter, and weighed. The result is generally rather too high, but the error is less the easier it is to remove the dye from the fabric, and the less of the latter goes into solution.

"If there is a large quantity of the arsenious sulphide, it is better to oxidize it to arsenic acid and estimate it volumetrically or gravimetrically."

[After oxidizing it can be precipitated as arsenic sulphide (As_2S_5), and weighed as such after removing the free sulphur with carbon-disulphide.—TRANS.]

Another process, which is very easy and accurate for small quantities of arsenic, is given by E. Reichardt (*Archiv Pharmacie*). He treats the article with dilute hydrochloric acid (1 to 5), and makes use of aliquot parts of the solution containing from 1 to 10 milligrammes of arsenic. Still smaller quantities can be used, but if more is taken part of it separates in metallic form in the evolution flask and escapes quantitative estimation.

Reichardt's apparatus consists of three thick bottomed flasks, each about 30 c. c. (1 ounce) capacity. In the first are a few small pieces of zinc covered with water, and through the cork passes a tube that dips in the water and has a funnel attached to the upper end by means of a rubber tube, so that when the funnel hangs down the tube is closed and no gas can escape or liquid ascend. Another tube connects it with the second flask, in which are 1 or 2 c. c. of argentic nitrate solution (1 to 24), the same quantity of concentrated nitric acid, and 4 or 5 times as much water. The third flask contains the same. To test the reagents one c. c. of dilute acid (1 to 5) is poured through the funnel and tube, and if this does not effect the silver solution for several minutes, a measured quantity of the liquid to be tested is put in the first flask. It must not be too acid, or the gas will go off too violently. If strongly acid, add some pure sodic carbonate. Silver will begin to separate, and when all the arsenic has gone off the solution of silver will become clear again and the metal all settle.

Bromine water is then added to the silver liquid in excess and well shaken, the bromide of silver filtered out, and a large excess of ammonia added to the filtrate, then the magnesia mixture, and let stand 24 hours. The precipitated ammonia-arsenate of magnesia is washed with ammoniacal water, dried, and ignited at a dull red heat. Of course the quantity found must be calculated to definite surfaces.

The latter part of the process is also applicable to large quantities of arsenic, as the sulphide which is obtained, mixed with sulphur, by precipitation with sulphydric acid, is easily converted into arsenic acid by bromine water, and can then be precipitated with magnesia, or introduced into the hydrogen apparatus after expelling the bromine.

I may here mention still another process which I employ when it is impossible to get colorless solutions, especially for colored varnishes—the coal tar colors, etc. In these cases I introduce weighed or measured quantities in very small proportions at a time into melted soda saltpeter, and use the solution of arsenite of sody for quantitative estimation by one or the other of the above methods.—*Chemiker Zeitung, No.* 103.

The Last Transit of Venus.

In a lecture delivered at Cooper Union, this city, on February 9, Prof. Young, after showing in the fullest manner the many methods of measuring the distance from the earth to the sun, and detailing all that had been hoped for from the observations of the transit of Venus, concluded that this last was a disappointment. The atmosphere of Venus prevented exact observation, and the measurements made with the planet Mars, by the astronomer Gills, were upon the whole more satisfactory. When the transit of Venus came around again in 121 years, it was doubtful if the event would be hailed with much enthusiasm. The fact was becoming known to astronomers generally that the system pursued by the French scientist Leverrier, that of calculating the earth's distance by the perturbations of the moon, seemed to contain the best elements of approximation to absolute truth.

Expulsion of Rats.

A writer in *Chambers's Journal* relates his experience in ridding his house of rats. He first tried the well known remedy of pouring tar into the entrance of their holes and also of placing broken glass by their holes, but neither remedy did he find effective. But bound to get rid of the rat nuisance, if such a thing was possible, he tried another well known remedy, which proved more satisfactory. He caught a couple of large rats in a trap alive, and then besmeared them all over, except their heads, with tar, and let them loose in their favorite run. But he says: I could not follow these two tar-besmeared rats into their numerous runs to see what would happen; but it is reasonable to assume that they either summoned together all the members of their community, and by their crestfallen appearance gave their comrades silent indications of the misfortunes which had so suddenly befallen them, or that they frightened their brethren away, for they one and all forsook the place and fled. The experiment was eminently successful. From that day, in 1875, till now, 1883, my house, ancient though it is, has been entirely free from rats, and I believe that there is no remedy equal to this one.

Railway Electric Lights.

An interesting experiment is now being tried on the Metropolitan District Railway, London, in connection with one of the suburban trains running from High Street, Kensington, to Putney, the carriages of which are lighted by electricity direct. In carrying this out, a Siemens dynamo and a Willans three-cylinder engine are placed in a luggage van which is attached to the train. Steam is supplied to the engine by means of a small boiler, which is also fixed in the van. The carriages are lighted by means of a total of twenty-eight Swan incandescent lamps of 20 candle power each, which give a very brilliant light. The present machinery was designed for a longer train, and, in addition to the lamps in the carriages, there are about thirty in the van which are always lighted when the others are. The object of this is to ascertain the exact cost of working a sufficient number of lights for the longer trains, which are usually fitted with fifty ordinary gas lamps. The experiment is being carried out for Lord S. Cecil, general manager of the District Railway, and Mr. J. S. Forbes, chairman of the London, Chatham, and Dover Railway Company. The first public trial of the light took place recently, and the results were considered very satisfactory. It is, therefore, intended to continue the experiment for some weeks, the train being all the time in regular work. In the event of the machinery proving effective and trustworthy, it is probable that a Willans engine and a dynamo will be placed on the engine of the train, so that steam can be supplied from the locomotive boiler. This arrangement, which has been proposed by Mr. W. F. Massey, of Twyford, will necessarily prove cheaper, inasmuch as the small boiler and the special attendant in the van will not be required. It is anticipated that the cost of lighting a train by electricity direct will be much less than that of oil lamps.

Enameling Cast Iron Ware.

Otto Holrenz, of Beresdorf, has devised a new process for preparing iron vessels for enameling. He sets out with the assertion that the enamel adheres to the white iron better than to gray, because the latter contains a mixture of uncombined carbon (graphite); hence, the articles to be enameled should be cast in iron, the surfaces of which are free from graphite. To accomplish this the mould in which the iron is cast is made of damp sand covered with a substance that will take up carbon and remove it. The best substance for this purpose is sulphur, which combines with the free graphite to form sulphide of carbon, which burns as soon as formed. Holrenz, therefore, dusts the moulds with fine sulphur powder, either alone or mixed with pulverized quartz or charcoal dust. The mixture contains more or less sulphur according to the quality of the iron used, but always has enough sulphur to convert the surface of the iron in contact with the mould into white iron.

The castings thus prepared are not pickled, as was previously customary before enameling, but the first or basic coating is applied directly to iron as soon as it has been mechanically cleaned or scoured.

A similar result is obtained by coating the mould with oil or petroleum, whereby a portion of the graphite is converted into a hydrocarbon, and this burns up when the casting is made.

Finally, to remove the graphite from the surface of an article already cast, it is coated with sulphuric acid of 60° B. and then ignited, when sulphuric acid that has penetrated into its pores acts upon the graphite as the sulphur powder in the mould does upon the fluid iron.—*Deut. Industrie Zeitung.*

Artificial Diamonds.

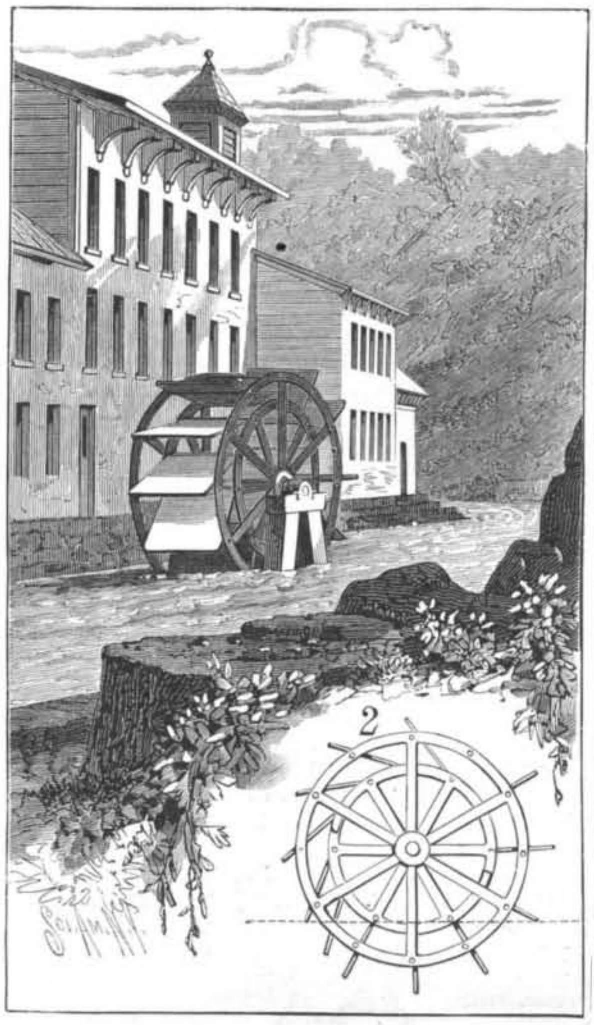
The importation of artificial gems, in which there has always been a large trade, has lately been greater than usual, a new French imitation diamond having proved quite popular. It is made of strass, a variety of flint glass containing more lead and in some cases a smaller proportion of borax, but the glass is subjected to a great heat and then plunged into cold water, whereby it is contracted so the grain becomes very close and fine. It is cut and polished like a real diamond, a leaden wheel with oil and diamond dust being used.

These artificial diamonds are called "heliolas," and are graded to conform to carat sizes of real diamonds, selling at from $20 to $50 per gross. A very small bit of foil is used as a backing, attached to the center of the back, reflecting the light into the heart of the stone. Such imitation "diamonds" are largely used for theatrical and fancy dress purposes, and in rolled plate jewelry of every form, besides being sometimes worn, it is said, by ladies owning real diamonds, and others whose financial condition has compelled them to part with their real gems. It requires the skill of an expert to determine the difference between the genuine stone and the new imitation.

A RECENT French law makes revaccination incumbent upon every student received into the lyceums and colleges. Since the experiment was made at the Lycee Louis le Grand not a single case of variola or varioloid has appeared.

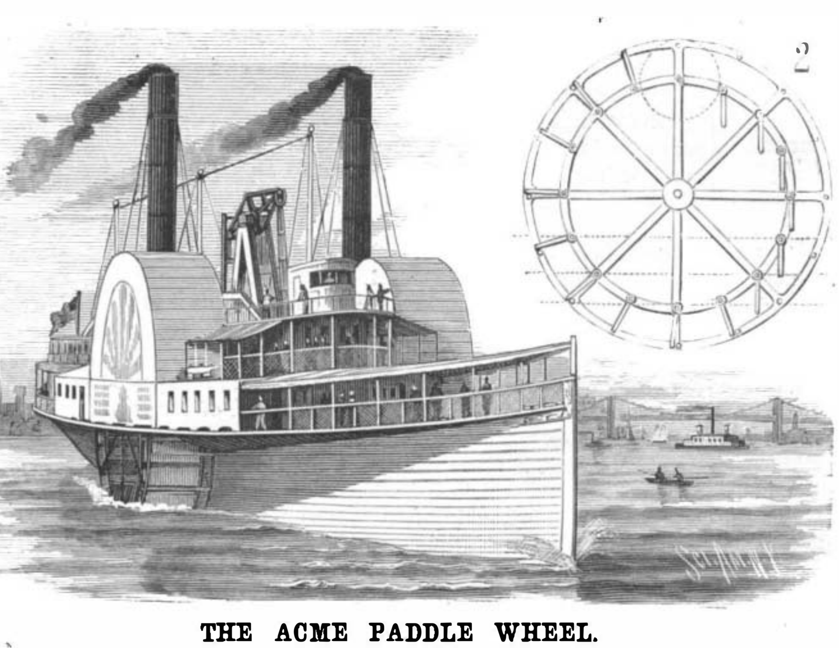
THE DUPLEX TIDE WHEEL.

The wheel shown in our first engraving will work with equal efficiency in both directions. The plan is simple, and permits all the parts to be easily and yet strongly and durably constructed. It consists of a rigid outer wheel and a loose inner wheel provided with stops, to limit its movement, and with hinged paddles held to their work by the connecting rods of the outer wheel. To the shaft are rigidly attached the side frames of the outer wheel, the rims of which are connected by as many rods as there are paddles. Upon the shaft, at the inner side of these frames, are placed the



THE DUPLEX TIDE WHEEL.

side frames of the inner wheel, the rims of which are connected by rods, and which are kept at the proper distance apart upon the shaft by collars united by bars or by a tubular washer. The inner wheel moves freely upon the shaft, but its movement is limited by blocks (shown in Fig. 2) attached to the rims of the frames of the rigid wheel, and which engage with the spokes of the inner wheel. To the connecting rods of the inner wheel, which is made smaller than the other, are hinged the inner edges of the paddles, which project between the rods of the outer wheel. From this it will be readily seen that the wheel will work equally well in either direction, the only lost motion being the distance the stop has to travel between the adjoining frames when the current is reversed.



THE ACME PADDLE WHEEL.

THE ACME PADDLE WHEEL.

Our second engraving represents a feathering paddle wheel, in which the blades are pivoted at their inner edges to the frame, and are held to their work by stops placed in the frame radially beyond the pivots, thus leaving the blades free to revolve in a full circle as shown in the sectional drawing. By this arrangement, when the wheel is revolved in either direction the paddle will revolve in the opposite direction until it is immersed, when it will be pushed through the water by the bars, thereby propelling the vessel in the opposite direction. With slow motion the paddles will dip edgewise into the water, as indicated in Fig. 2; with extreme speed the centrifugal force will carry them outward in a straight line from the shaft. In this case they meet a countercurrent nearly equal in velocity to that of the outer rim of the wheel, and will then feather to this current until acted upon by the bars. By reversing the motion the paddles will arrange themselves to their work in the opposite direction in one-half a revolution of the wheel. The wheel may be immersed in the water nearly to the main shaft and yet it will retain its propelling power, and for this reason it is adapted for seagoing as well as river and coast steamers. In Fig. 2 the dotted line shows the path which the paddle is free to traverse. Instead of one line of paddles there may be two or three arranged upon pivots in concentric circles. The inventor has found by experiments that this wheel is greatly superior to the ordinary rigid paddle wheel.

These inventions have been recently patented by Mr. C. L. Petersen, whose address is P. O. Box 2705, Boston, Mass. Patents applied for in England, France, Germany, and Canada.

Steel Spring Motors.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Wilfred Lewis read a paper upon the "Resilience of Steel," reviewing some of the means employed for the storage of energy, and showing the place occupied by steel among them.

Among the means now employed, compressed air, hot water, and the storage battery were cited from an English writer as being about equal in value, and as giving out about 6,500 ft. lb. of work per pound of material used.

Steel springs, according to the same writer, were said to yield about 18 ft. lb. per pound. In this connection the project of using steel springs as a motor for street cars was referred to as the most hopeless of all possible means of locomotion.

To test the accuracy of this statement in regard to steel, several experiments were made by the writer upon tempered specimens, both for tension and flexure. Contrary to expectation, the highest results were shown by the flexure of a small spiral clock spring weighing 2,040 grains, which gave out, when wound up, about 45 ft. lb. of energy, or in other words, 154 ft. lb. per pound.

The transverse strength of this steel within the elastic limit was found to be about 300,000 lb. per square inch, and its modulus of elasticity about 30,000,000. Such extraordinary strength, with such a low modulus, was so far beyond conjecture that it seemed to give a new hope for the success of the project referred to; but after making the necessary allowances for weight of car and efficiency of driving mechanism, it was found that not more than about 20 ft. lb. per pound of car would be available for locomotion. It was therefore improbable that such a car could ascend a hill over 20 feet high.

It was also a matter of doubt whether larger springs could be made to show results which would even approach these figures, and on this account the experiments about to be tried might be looked for with some interest.

Indian Fish-Egg Food.

We are indebted to Messrs. Fulda Brothers, of San Francisco, for a fine specimen of the fish-egg food prepared by the native Indians of British Columbia. The specimen received consists of a small branch of cedar, the leaves of which are thickly coated with dried fish eggs. Our correspondent says the eggs of the specimen sent are from a small fish that abounds in the waters of Vancouver's Sound, and are collected by making a mattress of cedar twigs and sinking them in shallow places until the fish have deposited their spawn, when the twigs are raised and the spawn allowed to dry. When wanted for use, they are simply soaked and eaten.

In this connection we will give the following item from a correspondent of the Chicago *Tribune*, who tells about fish and fishing in Sitka Bay, Alaska:

Drop a hook in any of these immense stretches of inland waters, and especially amid the Alexandrine Archipelago, and in a moment a fish will be at the bait. Rock cod, halibut, weighing from 40 to 150 pounds, salmon, fill all the streams and bays; and the herring! A fish story here will be apropos. During the spring of 1881 the writer was in Sitka, and was a witness to one of the most wonderful sights in the bay of Sitka. For more than a week the water of the bay, covering an area of fifteen or twenty square miles, was as white as milk with fish spawn, extending as far as the eye could see. The herring were so numerous that people were gathering them from the water along the beach with their hands and filling baskets with them. The Indians placed spruce boughs in the water, and when these were taken out not a particle of the original green but what was covered with a thick coating of eggs. An Indian in a canoe, with a stick about seven feet long, and for a distance of about two feet studded with nails, points outward, plied the water with this crude implement, each dip in the water bringing up from two to seven fish, and filling his canoe in somewhat less than forty-five minutes.