Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

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

TERMS.

One copy, one year, postage included.....................$3 20

One copy, six months, postage included.....................1 60

Club Rates:

Ten copies, one year, each $2 70, postage included.....................$27 00

Over ten copies, same rate each, postage included.....................2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII., No. 3. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 16, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

ANSTIE AND DUPRE ON THE ACTION OF ALCOHOL.

About the last literary work of the lamented Dr. Anstie was to describe, in *The Practitioner*, what with unconscious prophecy he called his "Final Experiments on the Elimination of Alcohol from the Body."

Though fatal to a fundamental position of the ultra-temperance party, that alcohol is treated by the body precisely like a poison and eliminated without chemical change, the investigations thus closed will be more fruitful for good to the genuine temperance cause, we believe, than anything else that has been done during the period of Dr. Anstie's labors. Moral and social reform can have no permanent basis other than in truth. And seeing no possible cure for the curse of intemperance except through remedies suggested by real knowledge of the physiological as well as the moral and social problems involved, we cannot but regard Dr. Anstie—notwithstanding the opposition of the nominal temperance party—as one of the truest and most efficient temperance apostles of the time. This in justification, not apology.

The controversy began, some fifteen years ago, on the appearance of M. Lallemand's work, in which, on the evidence of certain qualitative experiments detecting alcohol in the urine, it was asserted that alcohol passes through the system unchanged, This being true, the alcohol contained in wines and other spirituous beverages—as the temperance party were not slow to discover and teach—could be regarded only as a disturbing element, a poison, not only unserviceable to the system but positively harmful.

A result so strikingly in opposition to universal experience could not go long unchallenged. Among others, Dr. Anstie immediately instituted several series of experiments which proved that the idea of the non-destruction of alcohol in the body under normal conditions, and its copious elimination by the kidneys, must have arisen from nothing less than an experimental blunder. Except in conditions of profound alcoholic intoxication, there appeared in the urine only the most minute fraction of any substance which the comprehensive chromic acid test would lead one to believe might be alcohol: a position confirmed by the subsequent researches of Schulinus and Drs. Dupré and Thudichum.

In 1867 Drs. Anstie and Dupré together made another series of investigations, covering a period of six months, and carrying the question of elimination as regards the urine to a higher certainty of conclusion. It was found that when, during any twenty-four hours, not more than an ounce and a half of absolute alcohol by volume was taken—whether under the form of beer, wine, or spirit of any kind—it was never possible to obtain evidence of the presence, in the whole day's urine, of more than a small fraction of a grain of unchanged alcohol, reckoning as such everything that affected the bichromate test. When, however, the daily quantum of one and a half ounces of absolute alcohol was greatly exceeded, a larger portion of alcoholic substance was found in the urine, though nevermore than one or two grains, notwithstanding as much as three or four ounces of absolute alcohol had been consumed.

These experiments were followed, and in a general way confirmed, in 1870, by those of Drs. Parkes and Wollowicz, who, while admitting that it was quite improbable that any large amount of unchanged alcohol escaped through the kidneys, yet maintained that the amount might be larger than Drs. Dupré and Anstie had estimated, the period of elimination assigned by them being, it was said, too short.

The objection seemed well taken, and Dr. Dupré made, in 1872, a new series of investigations to test the matter more thoroughly. Two unexpected and very important observations resulted. Some time previously Dr. Dupré had established the fact that—contrary to the assumption of Lallemand—it was possible to recover from urine, by distillation, any alcohol it might contain, within an exceedingly minute fraction. He now discovered that there is, in the urine of persons who drink no alcohol, a small quantity of a substance, which not only affects the chromic acid color test precisely as alcohol does, but is similarly convertible into an acid which reacts precisely like the acetic acid derived from alcohol. If it is alcohol, it is certainly not alcohol which has been taken into the body as such, since it appears in the urine of teetotalers. He found further that this small normal constituent of urine represents that minute portion of supposed alcohol which can alone be found in the urine after moderate doses of alcohol. After narcotic doses, however, the larger quantity of material, capable of reacting like alcohol, which appears in the urine, undoubtedly represents a real alcoholic elimination.

As for the temporary retention of alcohol within the system, as had been suggested, to be eliminated by the kidneys at a later period, the facts were altogether adverse. For example, during the course of twelve successive days, during which something over nineteen ounces of alcohol were taken, not one thousandth part was eliminated by the kidneys; and the rate of elimination was no greater at the end than at the beginning of the period. There remained fully nineteen ounces of alcohol to be accounted for: it certainly could not remain unchanged in the system without creating violent disturbance.

Possible eliminations by the skin, the bowels, and the lungs remained to be tested. These were not, and had not been, neglected. Already Dr. Anstie had made many experiments, admittedly rude but still sufficient to prove that no considerable quantity of alcohol escaped by the skin except during dead drunkenness. In 1866 Dr. Dupré estimated the alcohol in the fæces of a typhus patient whose daily allowance of brandy was six ounces: the alcohol eliminated by the bowels proved to be less than one tenth of a grain in twenty-four hours.

The question was thus narrowed down to possible elimination by the lungs. This too had been repeatedly tested, and only the most trivial quantities were found to be so eliminated; and as Professor Binz subsequently pointed out, the amount would naturally be overestimated, since the volatile ethers, which we smell in the breath of persons who have been drinking wine, brandy, whisky, and the like, affect the chromic acid test precisely like alcohol. During the twelve days above mentioned, Dr. Dupré found, by methods proved by careful check experiments to be capable of indicating at least two thirds of the alcohol which might pass out with the breath, that about half as much alcohol was eliminated in the breath as in the urine.

Experiments like these would seem to be sufficient to dispose of the elimination theory; but more exacting ones followed, in consequence of Victor Subbotin's study of the action of alcohol on rabbits enclosed in a Pettenkofer chamber, a plan which made it possible for the whole of the excretions—breath, urine, dung, and sweat—to be collected, and the amount of alcohol in them estimated. The experiments made by Subbotin were unsatisfactory in that the doses of alcohol administered were enormous, and the rabbit is an animal specially incapable of withstanding severe alcoholic narcotism.

It was unfortunate at this stage of the investigation that London did not contain a Pettenkofer chamber large enough for research on human beings, and Dr. Anstie and his associate were unable to provide the four thousand dollars which one would cost. So they were forced to content themselves with a smaller apparatus and smaller animals. Dogs were selected, being known to bear alcohol with some approach to human tolerance for that substance. Two healthy terriers were chosen, one (A) weighing 10 pounds, the other (B) weighing 9 pounds 12 ounces.

We have no space for a description of the apparatus prepared, or the processes and precautions taken to guard against deceptive results. Suffice it to say that the experiments on the dog, A, showed that two drams of brandy, containing 47·73 grains of absolute alcohol, can be disposed of by a little terrier within eight hours, with the elimination of only one fifth of a grain of unchanged alcohol by all channels together. It was further ascertained (before brandy had been given) that there was in the dog, as in man, a small normal elimination of substances capable of reacting like alcohol.

With dog, B, the experiments were even more conclusive. For a period of ten days he was given daily one ounce of brandy, containing 190·92 grains of absolute alcohol, administered in two portions. On the eleventh day he was killed, quickly cut into minute fragments—bones, skin, and all—and the amount of alcohol in him carefully determined: or rather, the whole of the substances in the body and blood capable of yielding acetic acid. The experiments on this dog showed that a terrier of less than ten pounds' weight could take with comparative impunity nearly 2,000 grains of absolute alcohol in ten days; that on the last day of the regimen he eliminated by all channels only 1·13 grains of alcohol; and that on being killed two hours after swallowing half an ounce of brandy, there were recovered from his whole body and all its contents (elaborately treated, so as to provide against material loss during the examination) only 23·66 grains of what might be taken for alcohol, a considerable portion of it due, undoubtedly, to the normal constituents of the unalcoholized body, previously noticed.

These results tally so closely with those obtained from the human organism, by other methods, that it is altogether unlikely that the case against the theory of alcoholic elimination could have been made much more conclusive had Dr Anstie lived to submit a human subject to the chamber test.

Alcohol in less than narcotic doses is thus evidently disposed of almost entirely within the body. What becomes of it? That it cannot be stored up permanently in the body is proved not only by the experiments above narrated, but by the everyday experience of thousands of drinkers. The excess of ingestion over elimination would long since have stored their bodies with more than their own weight of alcohol, were there no internal disposition made of it. What can that disposition be? Does alcohol play the part of a food?

The complex function of food is (1) to build up the body; (2) to repair waste; (3) to maintain the bodily heat; (4) to evolve energy to be expended in internal and external work. Does alcohol meet any of these requirements?

There is no evidence, thus far, to show that its products can help in any way to form tissues; hence we cannot give it credit for building up the body or repairing waste. On the contrary, it seems rather to retard tissue change, either constructive or destructive. To those who hold the ancient doctrine that pysical energy is developed only by tissue destruction, the last-mentioned fact bars the way to any recognition of the possible usefulness of alcohol as a force producer. But every physiologist of standing now admits that the force required for the great bulk of the work done in and by the organism is evolved directly from the food carried to the several organs by the blood, without its previous employment in tissue forming. The objection is therefore groundless

The apparent inability of alcohol to perform the third part of the function of food, that is, to produce heat, affords another plausible but unsubstantial argument against the possibility of its food action. The observations of Dr. Parkes go to show that, so far from raising the temperature of the body, alcohol slightly depresses it. But too much must not be inferred from this fact. There is no heat-producing food of greater efficiency than beef fat; yet an ounce of beef fat would no more raise the temperature of the body than an ounce of alcohol.

Does alcohol meet the fourth requirement of food? A very large part of the available energy of the body is developed by the oxidation of hydrocarbon, like fat. Being a highly oxydizable hydrocarbon, it would be strange indeed, as Dr. Anstie remarks, if its oxidation did not prove to be the mode by which alcohol disappears within the system. There is much to sustain this view, and not a fact to disprove its correctness. The theoretical force value of the alcohol daily disposed of by multitudes of sober people is very great. It is incredible that so much alcohol can be transformed in the body without the evolution of energy, for good or evil. It does not, in the temperate people in question, produce any visible disturbance of their bodily functions. It must therefore be vitally useful, and belong, where Pavy and universal experience put it, among the force-producing foods, its usefulness depending very largely, it would seem, in the rapidity of its transformation, and the promptness with which it supplies available energy.

This, it is proper to add, with important limitations. Beyond a certain small dosage, perhaps six or eight hundred grains in twenty-four hours for an average adult in health, alcohol is demonstrably a dangerous narcotic poison, not the least of its disadvantages being that it cannot be eliminated to any considerable extent. If employed at all, in health, it is obvious that it should be used for special purposes and with great care, unless it be in the diluted condition in which it appears in cider, beer, or light wine.

In many diseases, the system seems to be able to make use of almost unlimited quantities of alcohol, with strikingly beneficial effects; but that is a field upon which it would be out of place here to enter.

OUR NAVAL EFFICIENCY.

Large standing military establishments have always been justly viewed as unnecessary and inexpedient in this country; and it is the standing argument, of those who would defend the paucity in numbers of our war vessels, that we can afford to remain quiet, watching the development and trial of new systems by foreign nations, gaining experience without sharing in its cost, and simply maintaining a nucleus which, in time of need, the resources of the country could speedily augment to formidable dimensions. In the abstract, certainly, no exception can be taken to this reasoning, but unfortunately practice and theory are at wide variance. Instead of devoting moderate sums to the thorough construction and maintenance in the highest possible efficiency of a small number of vessels which, though even not embodying the very latest refinements, are nevertheless types of their kind, the enormous sum of fifty millions of dollars of the people's money has literally been frittered away during the past five years in tinkering old ships of war, not one of which is thoroughly fit for severe service. Three million two hundred thousand dollars has been appropriated for eight new sloops, it is true, but this is not included in the above amount; nor is any portion of the same, except one million dollars, chargeable to any other necessary expenditure save repairs. The money that has been wasted is sufficient to have provided a powerful fleet, armed with every accessory of modern warfare, instead of a navy the crack ships of which could not, as the Key West drill proved, steam at a higher rate in company than four and a half knots per hour, and which are armed with guns contemptible before the modern European ordnance.

A very brief examination of the present condition of the array of vessels now borne on the navy register, as recently given by the *Army and Navy Journal*, will show to the reader that the status of affairs is the reverse of encouraging. Beginning with the wooden vessels, there are five large steam frigates; one is utterly rotten and worthless, and the newest of the rest, the Franklin, built shortly after the war, is armed with old-fashioned smooth bore 9-inch guns, and can, as the writer knows by personal experience, just hold her own against a stiff gale, under full steam power. The next class or second rate includes thirty-three vessels; three are old paddlewheel ships twenty years and over old, one being changed to a screw steamer. Eight are "Isherwood's failures," rotten, not worth repairing, and will shortly be broken up. Five are old-fashioned but in moderate condition; the boilers are so placed as to be unprotected. Four have Isherwood engines and Martin boilers, and are small vessels built of white oak, moderately rotten. Five built before the war are the best vessels in the service. Six are not launched, one never will be, the rest have engines—Isherwood again—every one of which has gone into the scrap heap. One is being tinkered at, and has cost two and a half millions alone thus far for repairs, and one has never been to sea except for a deceptive trial. Her total weight is 4,339 tuns, and of this her machinery and coal alone weigh 2,010 tuns.

The third class numbers twenty-four vessels; one, the Swatara, has been rebuilt and fitted with compound engines. She consumes 15 tuns of coal under six boilers per 24 hours, and makes an average speed of 6½ knots. Five are in fair condition, though merely old-fashioned gun boats. One has had her machinery condemned and is being repaired. Two are old sailing vessels on which attempts at conversion into steamers are being made. Two are unsafe in a seaway; two are condemned and are to be broken up. Another is old and useless. Two are in Asia and cannot get back; two are unseaworthy. Two more are worthless, and are to be repaired, if possible. Five are three-gun gunboats, (boilers above the water line and bad machinery), and the last is an old paddle wheel steamer, 25 years old, stationed on Lake Erie. The fourth class includes a couple of old blockade runners and some dispatch boats.

The ironclads number fifty-one. There are twenty "light drafts," which are condemned and perfectly worthless. The department is selling them at any price. Next, there are seven of about 1,200 tuns displacement. These have laminated armor, which guns equal in power to the 7, 8, and 9 inch Woolwich rifles can pierce like so much cardboard. Six monitors have about 1,500 tuns displacement, open to the same fatal objection. Four are double turreted, and displace 3,000 tuns. These have green white oak hulls, thoroughly rotten, and armor also no shield to modern heavy projectiles. Four more are on the stocks, have never been launched, and are so much decayed that it is recommended that they be broken up. Three are a remnant of the old Mississippi flotilla, of course now of no value. The Dictator has weak armor; but if this could be replaced with solid plating and modern guns be mounted in her turrets, she would be one of the most formidable ironclads afloat. The same may be said of the unfinished Puritan. The Roanoke is an old frigate razeed and covered with worthless armor.

Add to this category a few tugs, two torpedo boats, and a few ancient sailing vessels (used for practice, store, and receiving ships), and the entire United States Navy is summed up.

PRINTING THE PATENTS.

Recently, in the House of Representatives, the committee on appropriations reported a clause authorizing the expenditure from the patent fund of $40,000, for producing copies of current and back issues of the patents, whereupon several gentlemen took occasion to express their sentiments.

It is gratifying to observe that all of the speakers were in favor of having the back patents printed as early as practicable; and although they did not sanction a sufficient appropriation for the work this time, they did something towards it, and expressed the opinion that next year it should be wholly accomplished. Mr. Meyers thought that the proposed printing would greatly benefit inventors. "We should," he said, "consult their best interests, and in doing so will always best develope the inventive genius of our people."

Mr. Conger said: "I think it very necessary and essential to the interest of inventors, who pay all these expenses in the end, that as large an amount as it is possible shall be appropriated."

Mr. Garfield was in favor of a larger appropriation, but thought it impracticable at present to use it, owing to the crowded state of the Patent Office, and the consequent necessity of hiring space, at a heavy cost, if additional drafts-men were to be employed.

NINE THOUSAND dollars has thus far been contributed toward the Agassiz monument.

THE CULTIVATION OF OYSTERS.

In our last issue, we traced the oyster from the spawning bed through its four or five years of development. It is now on what may be called the fattening ground, the firm gravelly bottom of a channel between rocky islands, swept by a tide which runs like a river in flood. Here the oysters spend their last season, with as much enjoyment, we fancy, as oysters are capable of. The conditions of oyster life are here evidently at their best, for the oysters improve astonishingly, doubling in bulk of meat, it may be in six months. Here the crooked are made straight by their own efforts, the slender grow broad and round, the lank become stout, and the flesh of all grows plump and hard to the very gills. Notice the difference between the opened "natural" and a "transplant" of corresponding age, especially in front of the circular muscle commonly called the heart!

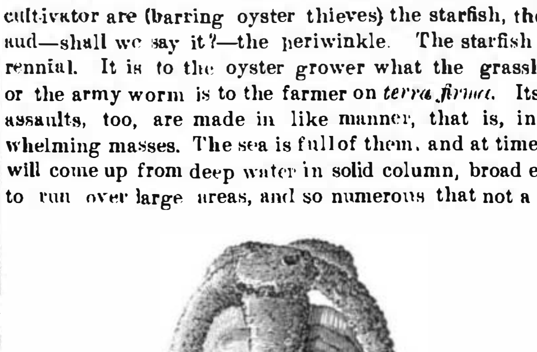
But the oyster is not yet in condition to tickle the palate of the epicure. It is full of bitter, salt sea water; the gills are discolored, and the whole system needs renovating. It must have a drink of fresh water. The common run of oysters are taken direct from the "salt" to the market. Not so the fancy product of cultivation. These are taken to the mouth of a sweet-watered river and placed for a few hours in a shallow float, which swims near the surface of the water. Here the oysters "drink," as it is technically called, spirting vigorously, and freeing themselves of all deteriorating matter. Open one now. It lies plump and white in the shell, rounded to the gills, which are scarcely visible, in every part clean and tempting to the most fastidious. Taste it, and know how sweetly delicate an oyster may be!

Not many people know it, but there is as great a difference between a thoroughbred oyster, properly handled, and an ordinary oyster such as one sees in the markets, as there is between a rough seedling pear and a Bartlett which melts in the mouth. Those who have learned the difference experimentally will eat no other where the cultivated are to be found.

The variety we have been studying are genuine "saddle rocks," raised on their native soil. Other varieties differ in color and flavor, and have their local admirers; but none surpass the true saddle rock in all the qualities that form the perfect oyster.

We set out to describe the cultivation of oysters, and have done so as one might describe the cultivation of wheat in Nebraska, omitting to mention grasshoppers. It will not do, however, to leave out the shadows of the picture. The oyster eater may care but little for the long battle that has been waged with various enemies to secure the development of the savory morsel that lies before him on the half shell; but to the man who raised the oyster it is a matter for serious consideration. If a crop of wheat required five or six years to come to maturity, and during all that time was subject to invasion by destructive insect pests, not to mention human marauders and elemental dangers, it would bear some resemblance to a crop of oysters. The likeness would be still closer if the attacks were made invariably in the dark. It is hard watching against enemies which work under cover of from ten to a hundred feet of water.

The chief animate enemies of the oyster and the oyster cultivator are (barring oyster thieves) the starfish, the drill, and—shall we say it?—the periwinkle. The starfish is perennial. It is to the oyster grower what the grasshopper or the army worm is to the farmer on *terra firma*. Its worst assaults, too, are made in like manner, that is, in overwhelming masses. The sea is full of them, and at times they will come up from deep water in solid column, broad enough to run over large areas, and so numerous that not a living

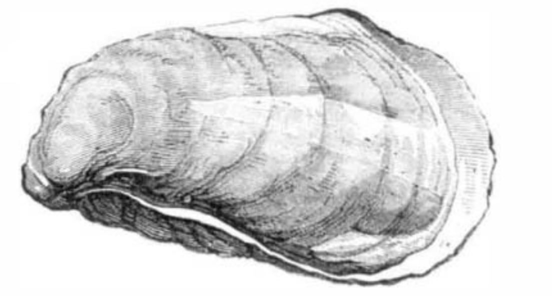


STARFISH AT WORK.

thing remains in their path. Miles of oyster beds have been laid waste by them, and the perpetual possibility of such invasions makes the oyster grower's investment extremely precarious. It is only by constant dredging that it is possible to do anything on the north shore of the Sound, the cost of carrying on the war, with the losses entailed, making the heaviest of the oyster breeder's taxes. On the Long Island shore they have been, we are told, less troublesome of late. By persistent labor many grounds formerly given over to their ravages have been recovered; and when steam comes to be more generally used in dredging, it is possible that the pest may be quite overcome and exterminated.

A short time ago one of our scientific cotemporaries published a digest of a French report, in which the starfish was described as helping to complete the work of destruction begun by the drill. It would be fortunate, indeed, for our oyster breeders if the stars were thus dependent. It is true enough that the drill paralyzes the oyster (chiefly those under three years old) by boring a hole into the oyster's heart, as its large muscle is called; but the star waits for no such intervention. On the contrary it destroys both the drill and the oyster, and every other mollusc it comes across.

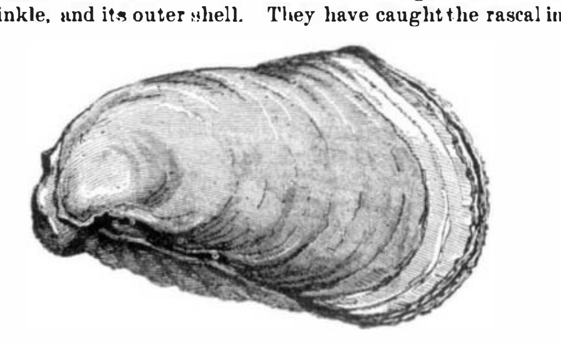
In the current issue of the *Popular Science Monthly*, Mr. Lockwood gives a more correct account of this baleful star's proceedings. He errs, however, in saying that the star merely clasps the oyster, then patiently awaits its opening, whereupon it drugs its victim as a burglar might blow chloroform through the crack of a partly opened door. The rapidity with which stars destroy oysters, and the invariable corrosion of the outer edge of one of the valves of the oyster's shell, making it shorter than the other and the junction of the



WORK OF STARFISH.

two imperfect, is evidence enough that the burglar waits for no opening of the door. By what process the shell is eaten away, whether by an acid secretion or otherwise, we do not know. That it is eaten away, the shell of every oyster killed by stars bears unmistakeable testimony.

The case of the periwinkle is less clear. The assertion of certain naturalists that the 'winkle is a harmless and innocent vegetarian is met with such derision, by oystermen, as shepherds would be likely to greet the assertion with that wolves eat nothing but grass. They regard 'winkle as the chief destroyer of mature oysters, and will show you just how the oyster's nose is broken off between the tough foot of the 'winkle, and its outer shell. They have caught the rascal in



WORK OF PERIWINKLE.

the act time and again, with more or less of the oyster devoured. It is a pretty case of conflicting testimony as it stands, possibly one of mistaken identity.

The drum fish, which makes such havoc among the oysters of other localities, is but an occasional visitor in the Sound, and never in sufficient force to do much harm.

It must not be supposed that this exhausts the list of the difficulties and dangers which the oyster grower has to contend against. Inanimate as well as animate Nature bears hard upon him in more ways than we have space for mentioning. Nevertheless endurance, pluck, and energy prevail in this as in other forms of industry, especially new ones, in which everything has to be learned by experience. Though greatly extended during late years, the business of oyster culture is yet in its infancy. It cannot fail to become more and more important as rapid transit broadens the area over which live oysters may be distributed, and more of the inhabitants of the interior learn to know the oyster's capabilities.

In closing, we must express our special indebtedness for information, for opportunity to study the workings of oyster culture on the spot, and for the specimens selected for these illustrations, to the Messrs. Hoyt Brothers, oyster farmers and dealers in fancy oysters, at Norwalk, Conn.

Prizes for Chemical Discoveries.

The following prizes for chemical discoveries are offered by the *Société d'Encouragement*, Paris: Disinfection and prompt clarification of sewage, $200, 1875. Ink not attacking metallic pens, $200, 1875. Economical production and application of ozone, $600, 1875. Fixation of atmospheric nitrogen, either as nitric acid, ammonia, or cyanogen, $400, 1876. Artificial production of graphite, suitable for lead pencils, $600, 1877. Artificial preparation of a compact black diamond, $600, 1877. Industrial application of oxygenated water, $400, 1878.

The Railway World.

This is the title of a new and handsome weekly paper, 16 quarto pages, $4 a year, lately established at Philadelphia. It is the successor of the United States *Railroad and Mining Register*. If we may judge from the contents of the first number, the new periodical is in the possession of the real requisites for success, namely, ability and enterprise. We cordially wish for it the highest prosperity.

IT is reported that the owners of the Great Eastern are contemplating the project of turning the ship into an immense hotel, and sending her to the Centennial Exposition.