strongly felt, the oysters along this coast attain a quicker and finer development than elsewhere, the culminating point being in the swift channels among the rocky islands off Norwalk—the home of the original "Saddle rocks," the "Sounds," and other standard varieties: all the same oyster though differing, in size, shape, color, and flavor, with the position and character of their bed and the accidents of their development.

Twenty years ago, the oyster business of this region was carried on precisely as described in the *Popular Science Monthly*; that is to say, artificial propagation was unknown, and, when the native grounds were exhausted, the supply was kept up by restocking them with "seed," or small oysters brought from the Chesapeake Bay or the Hudson river. Among the oystermen of Norwalk at that time were the Hoyt Brothers, young men who brought to the business more than the usual allowance of brains. Not satisfied with merely handling oysters, they sought to understand them, studying them in the water and out of it with a persevering directness that would have delighted the heart of Agassiz. Observing that native spat would sometimes settle upon seed brought from abroad, they set to work to discover the conditions of such fixing of the spawn, rightly arguing that, the secret once penetrated, they might save themselves the trouble and cost of going elsewhere for seed, besides securing a better breed of oysters.

Had they known anything of European experiments in oyster culture, they might have got on faster at first: they might also have been led astray and discouraged, as others have been, by fruitless imitations of foreign methods. The climatic and other conditions here are so unlike those of France or Italy that entirely different methods of oyster culture are required. On the whole, therefore, it was fortunate that the Hoyts had to begin at the bottom and learn everything by personal observation and experiment. It was fortunate, too, that with Yankee common sense they pitched upon the master key to the problem at first, and sought to discover the natural conditions of oyster propagation on their own grounds. One year the Sound's bed will be literally covered with oyster spat; the next, it may be, though the oysters spawn as abundantly, scarcely a young oyster will be found. Again there will be a year, like 1873, when there will be no spawn. Their problem, it will be seen, was no easy one to solve.

After much study of oysters and oyster grounds, and many trials with different materials for fixing the spawn, our experimenters learned at last that the securing of a crop of seed depends upon two essential conditions: first that the parent oysters spawn; second, that, at the time of spawning, the floating spat must have presented to them something clean to which to attach themselves; it may be stone, shell, glass, iron, wood, leather, anything, in short, provided it is perfectly clean. The first great point in artificial oyster propagation is therefore to know just when to have the stools on the ground. The time of spawning varies with the season, the position of the bed, and the depth of water over it, so that it requires close watching, with frequent dissections, to determine the precise moment when the spawn begins to run. If the stool is presented too late, the spawn is lost and the stool worse than wasted; if too soon, it is equally thrown away, since it becomes covered with white slime in a few days, and then the spat cannot strike. Sometimes a heavy storm at spawning time comes to the aid of the oyster farmer, and adds immensely to the productiveness of natural beds: it churns up the gravel and shells on the bottom, scours them clean, beats the slime off the rocks, and brightens things generally for the reception of the coming spat. Last summer the spawn was abundant; the natural conditions for its lodgment were unusually favorable; and if the starfish and other enemies of the oyster do not destroy the crop, it will be an unusually productive one. But we are getting ahead of our history.

Having come to the conclusion that clean stools at spawning time were the one thing needed to fix the native spawn, the Hoyt brothers gathered up some thousands of bushels of weather-worn shells and scattered them over their grounds. Naturally they were laughed at by "practical" oystermen, who had been in the business for years and knew "all about it"; while other men threatened them with all sorts of penalties for filling up the channels and otherwise interfering with the natural order of things. Their venture, however, proved eminently successful; the clean shells were quickly covered with spat, and sixteen years ago they reaped their first crop of artificially propagated oysters.

There is nothing that commands respect like success. Seeing the result, those who had scoffed at the method were eager enough to try it. A new impetus was given to the oyster business. Exhausted oyster grounds were restocked, and miles of hitherto unproductive ground were brought under cultivation. From Greenwich to Westport there is not a break in the oyster beds, the great bulk of them owing their existence to artificial propagation.

The stools chiefly prized are shells and screened gravel, ranging in size from a hickory nut to a hen's egg. The fragile amber-colored shells which abound throughout the Sound—the oystermen call them "gingles"—make excellent stools: so do scallop shells, boat loads of which are brought from the Rhode Island shore for this purpose. Large stools are less desirable, since the oysters crowd and pinch each other on them, and the bunches are harder to separate when the time for transplanting arrives. Still in many cases it is necessary to scatter comparatively large shells and stone, among the finer shoals, their action being apparently to create little rests or eddies in the water flowing over the bottoms, thus enabling the spawn to strike.

In the costly tile and cone devices for taking spat, employed by the French systems, which have, by the way, superseded the methods described in the *Popular Science Monthly*, the fixing of a few hundred thousand spat is accounted something wonderful; and much to the amusement of our oyster growers, American newspapers have copied French reports, wonderment and all, when within an hour's ride of their publication offices are breeding grounds of many acres, sown with spat in countless millions. Our oystermen number such small things only by the bushel. Over large areas, this year's seed is so plentiful that an ordinary "drag", holding a bushel or more, will be filled by drawing it loosely over a strip of bottom a yard wide and a rod long. A bit of shell as big as one's finger nail will carry perhaps half a dozen spat, and as many as sixty or eighty may be counted on a single valve of an oyster shell.

The diminutive breeding grounds which the French make so much of—creeks and puddles, we have heard them called by men accustomed to the larger spaces under cultivation here—compare with those of Long Island about as a kitchen garden with a Californian wheat farm. The difficulty along the Connecticut shore is not in propagating the oyster —that is easy enough now—but in maintaining the crop until it is mature. It is only by the most persistent warfare against star fish and other oyster enemies that uniform success is possible.

In another article, we propose to describe more minutely the processes of oyster culture and the effects of it, also the obstacles which our oyster breeders have to contend with.

THE COAL AND IRON PRODUCTS OF THE WORLD.

M. Gruner's report on the coal and iron industries of the world, which has lately appeared in France, is a document evincing laborious research, and one which, to the student of political economy and to the statistician, cannot but be of the highest practical utility. The author was a member of the International Jury at the Vienna Exposition, and it has been his object to compare the conditions of the two great industries as existing in 1873 with their state at the time of the French Exposition in 1867. While we cannot follow the details of the long report, there are, nevertheless, many general results and conclusions which will prove both instructive and interesting.

M. Gruner estimates the entire fuel production of the world at 250,000,000 tuns, and he calls attention to the fact that the value of the mineral combustible annually consumed largely exceeds that of the ores mined. In England, in 1871, the total coal yield was valued (in round numbers, which for convenience' sake we shall use throughout this article) at $92,000,000, while that of all the other mineral products, including refractory clays, marine salt, phosphorites, etc., did not exceed $62,000,000. In Germany and France the same excess in favor of coal also appears. Throughout the entire world during 1872, the author places the value, of all the minerals but fuel, mined at $320,000,000: of the fuel at $620,000,000, or nearly double.

Referring to the English coal production, the author states that, for the forty years from 1831 to 1871, the ratio of increase has been as from 1 to 6. The present rate of production per workman is about 299 tuns per annum in England, 220 in Prussia, 159 in France, and 157 in Belgium. It is believed that these figures will never exceed 300 tuns in England, and 160 in France and Belgium; so that, estimating by the present English yearly increase in fuel mined, in the year 1910 fully 2,000,000 men will be actively engaged in the industry. This is hardly possible, since the above number of working men support a population five times greater; and for this aggregate to be maintained by a single industry, there must be a corresponding increase in all the other branches of English labor. Hence, from the nature of things, a maximum of coal production must be eventually reached. Regarding the final exhaustion of the English mines, the author places their duration at 750 years.

The aggregate production of 250,000,000 tuns in 1872 is made up by the various countries in the world contributing as follows: Great Britain, 123,000,000; United States, 40,000,000; Germany, 40,000,000; France, 15,900,000; Belgium, 15,600,000; Austria and Hungary, 10,000,000; Spain, 1,000,000; Russia, 800,000; and English colonies, China, Chili, and Japan, 3,700,000. It is believed that within thirty years the American coal production will exceed that of England; but the indefinite increase of the yield, it is thought, will be prevented by the absence of a corresponding increase in the demand, in the same manner as in Great Britain.

After thus dealing with coal, the subject of iron is discussed, and the value of its ores stated to exceed that of all those of other minerals save gold. At a minimum, the annual value is placed at $70,000,000, or $2 per tun on the aggregate extraction of 1872. From the 35,000,000 tuns then mined, 14,000,000 were made into cast iron, 8,500,000 into rolled or forged iron, and 1,000,000 into homogeneous iron and steel. On comparing these figures with those given for 1865, the iron production is shown to have become still more rapidly developed than that of coal. In seven years the coal yield increased from 9 to 12·5, while that of iron increased from 9 to 14. The steel manufacture has tripled in the same period.

THE Pittsburgh *Commercial* explains the origin of a very foolish, sensational story as to the possibility of Pittsburgh being destroyed, wholly or in part, by the caving-in of the soil from the action of subterranean fires. It is merely a deserted coal pit, which has been smoldering for 30 years past, without damage or danger.

THE death is announced of the General Marquis de Laplace, son of the great astronomer, at the age of eighty-five. He began his military career under the first French Empire.

TO OUR PRESENT AND FUTURE SUBSCRIBERS.

We call the attention of our subscribers, and the public generally, to the new prospectus of the SCIENTIFIC AMERICAN, for the year 1875, published on another page of this issue.

In about ten days, each one of our mail subscribers will receive a handsome subscription list, printed in colors, a catalogue of publications issued from this office, and a chromo pocket calendar for 1875. The publishers of the SCIENTIFIC AMERICAN will esteem it a personal favor if every present subscriber will take the trouble to circulate the subscription list when he receives it, and ask some of his friends to join him in taking the paper for the coming year.

Notwithstanding that the SCIENTIFIC AMERICAN has a much larger circulation than any paper of its kind ever attained, and the fact that each year its sale increases several thousands over that of the previous year, we believe that it merits a still larger patronage; and we shall not be satisfied until its weekly issue reaches one hundred thousand copies.

Next week we shall print both our Special Edition and the regular issue, amounting to ONE HUNDRED AND FIFTY THOUSAND COPIES, and we shall commence the new volume by printing fifty thousand every week, relying upon our old friends and subscribers to furnish new names, enough, with the renewal of their own subscriptions, to enable us to exceed that number soon after the commencement of the year.

The public attention is called to the inducements for new subscribers, published in the prospectus already alluded to.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE CHEMICAL EFFECT OF THE PHYLLOXERA ON GRAPE VINES.

To those who may be experimenting in search of a remedy for the phylloxera, so as to gain the $60,000 reward offered by the French government, the following table, showing the chemical effect of the insect upon the vine, will be of interest, and perhaps may lead to a more intelligent investigation

	Healthy vines, per cent.	Attacked vines per cent.
Bark of fresh roots: Cane sugar	2	0
Glucose	0	1
Fresh roots without bark: Albumen	2	0·6
Oxalic acid	17·80	4·04
Roots dried at 212° Fah.: Pectic acid	6 20	1·90
Tannin	9·60	7·68
Radicles dried at 212° Fah: Carbonate of potash	1·48	0·428
Total ash	6·42	12·85
Leaves dried at 212°, collected in June: Carbonate of potash	1·35	0·72
Total ash	8·80	2·95
" collected in September: Carbonate of potash	0·72	0·39
Total ash	13·25	13·00
Branches dried at 212°: Carbonate of potash	1·90	0·26
Total ash	3·45	3·49

RECENT EXPERIMENTS ON EXPLOSIVES.

In experimenting upon dynamite, not long ago, M. M. Roux and Sarrau found two kinds of explosions. The simplest, or, as it is termed, of the second order, is caused by the ordinary inflammation of the substance; the explosion of the first order, or detonation, is produced by the percussion of a powerful priming such as fulminate of mercury. These two explosions are such that the same quantity of the substance, deflagrating in the same capacity, causes therein very different pressures. Later investigations prove that this remarkable quality of dynamite belongs also to the majority of explosives. Nitro-glycerin, pyroxylin, picric acid, and the picrates of potash, baryta, strontium, and lead, detonate by fulminate of mercury. Ignited with an Abel capsule (or when this does not suffice, with a small quantity of powder), an explosion of the second order is produced.

Gunpowder, either in grains or in a dust, does not detonate with fulminate of mercury; but by using nitro-glycerin as an auxiliary detonator, itself being excited by the fulminate, an explosion of the first order is obtained in the powder, very different from the ordinary explosion. This takes place under all the conditions in which gunpowder is commonly employed.

ZINC A PREVENTIVE OF BOILER INCRUSTATION.

An engineer on board the *St. Laurent*, a steamer plying between this port and France, after making some repairs in the boilers, left accidentally therein an ingot of zinc. Some time after, in searching for the bar in the generator, in which, meanwhile, steam had been maintained, he found to his surprise that the metal had disappeared, and also that the incrustation left by the water, instead of being hard and firm, was a mere mud, easily washed out. Repeating the experiment over another voyage, the same result was reached. M. Lesueur, of Angers, France, after examining into this circumstance, thinks that the zinc forms a voltaic couple with the iron of the boiler, zinc being the negative pole and the iron the positive. It then happens, as in all batteries, that the zinc is consumed; while the iron is protected both from oxidation and dissolution.

WE are informed that the Attorney General has considered the question, whether the subscribers to the Patent Office Tea Party Testimonial are liable to the penalty prescribed in the Act of Congress in such cases. It is further stated that, for reasons of State, the decision is withheld from the public. Can any one inform us whether there has really been any official action in the matter?