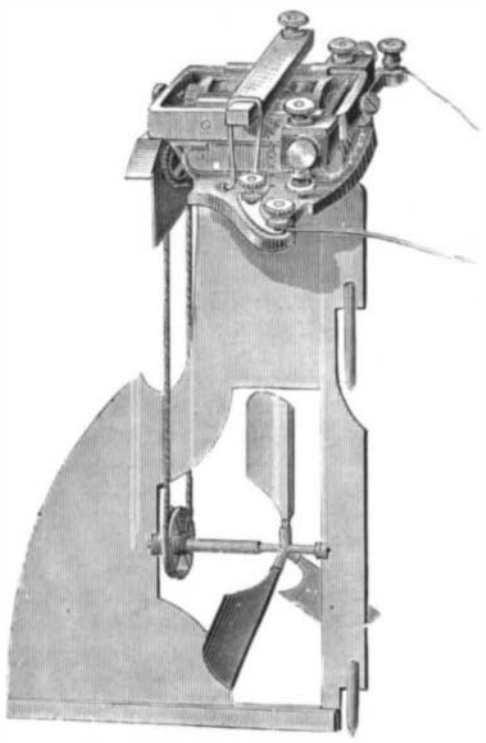
in the other circuit. In a delicate instrument of this kind the tension of the expansion wires should be only sufficient to keep the wires taut, as they are readily stretched when considerably heated.

THE ELECTRIC BOAT.*

Mr. G. Trouvé has just constructed an electric motor specially adapted to be used in a row boat or canoe. He made his first public experiment on the 26th of May, in Paris, on the Seine, in the presence of MM. Berger, Commissioner



THE ELECTRIC BOAT—DETAILS OF PROPELLING MACHINERY.

General of the Exposition Universelle d'Electricité, Antoine Breguet, editor of the *Revue Scientifique*, and numerous other spectators, who were greatly astonished to see the boat moving against the current without oars or the smoke generally inseparable from the steam engine.

This electric motor is furnished with a Siemens armature connected by an endless chain with a screw having three paddles, and placed in the middle of an iron rudder. The motor is placed on the upper part of the rudder, so that both the motor and propeller follow the movements of the rudder.

This motor, with all its accessories, only weighed five kilogrammes, and was placed in the rear of a little barge about five meters fifty centimeters long, by one meter two centimeters in breadth, and weighing eighty kilogrammes.

In the middle of the boat were placed two secondary batteries weighing twenty-four kilogrammes. Mr. Trouvé prefers two batteries, as they are more easily managed and have the advantage that they can be used either together or separately; also that in the evening one can be used for propelling and the other for lighting the boat.

The secondary piles are connected with the motor by two cords that serve both to cover the conducting wire and to work the rudder, and are furnished with handles that can be used to regulate the electric current.

This electric motor is complete in itself, and can be placed on a small boat. It is arranged in such a way that it does not interfere with the action of the boat or the use of the oars.

The ingenious inventor, before deciding on the endless chain, made various experiments with the different ways of propelling by cog-wheels by an endless screw and by friction. He found the two first too complicated and too easily clogged by the sand, branches, etc., floating in the water to be advantageously used, while the latter system, though perhaps the better, presented numerous practical difficulties. The endless chains are the best adapted for actual use, as their slower movement is more than compensated by their greater strength and regularity.

Besides her experimental trip, this electric boat has at six different times easily navigated the Seine for a distance of 200 meters. It is found that the boat, containing three persons, stemmed the current at the rate of one meter a second, and descended with a speed of two meters five centimeters. The current of the Seine at this place runs about twenty centimeters a second.

These trials are very interesting from an experimental point of view, and will, we hope, be an incentive to more important works. These will assuredly take place when the supply of electricity is more easily procured, for it cannot be denied that the present electric pile is not an advantageous arrangement, as it is difficult to mount and its power is limited.

Three experiments recall those made by Jacobi in 1829 to navigate the Neva by electricity. We reproduce from the *Merveilles de la Science* the account of this interesting attempt, which well deserves to be called the origin of electric navigation.

The voltaic apparatus that furnished the electricity to Jacobi's motor was composed of two Grove batteries, each containing sixty-four pairs of cells, the whole covering thirty-two square feet. This furnished so powerful a current that a piece of platinum wire, 2 m. long and as thick as a piano string, was immediately heated to a red heat on being exposed to the electric current.

There was so much nitrous gas liberated by the pile that the operators were seriously incommoded, and were several times obliged to interrupt their experiment.

The spectators, who stood on the banks of the Neva, were also forced to retire on account of the suffocating odor of the liberated gas that the wind blew on to the shore.

The barge, which was made with paddlewheels, and was large enough to hold twelve persons, succeeded, however, in sailing several hours on the river against both wind and tide.—*La Nature.*

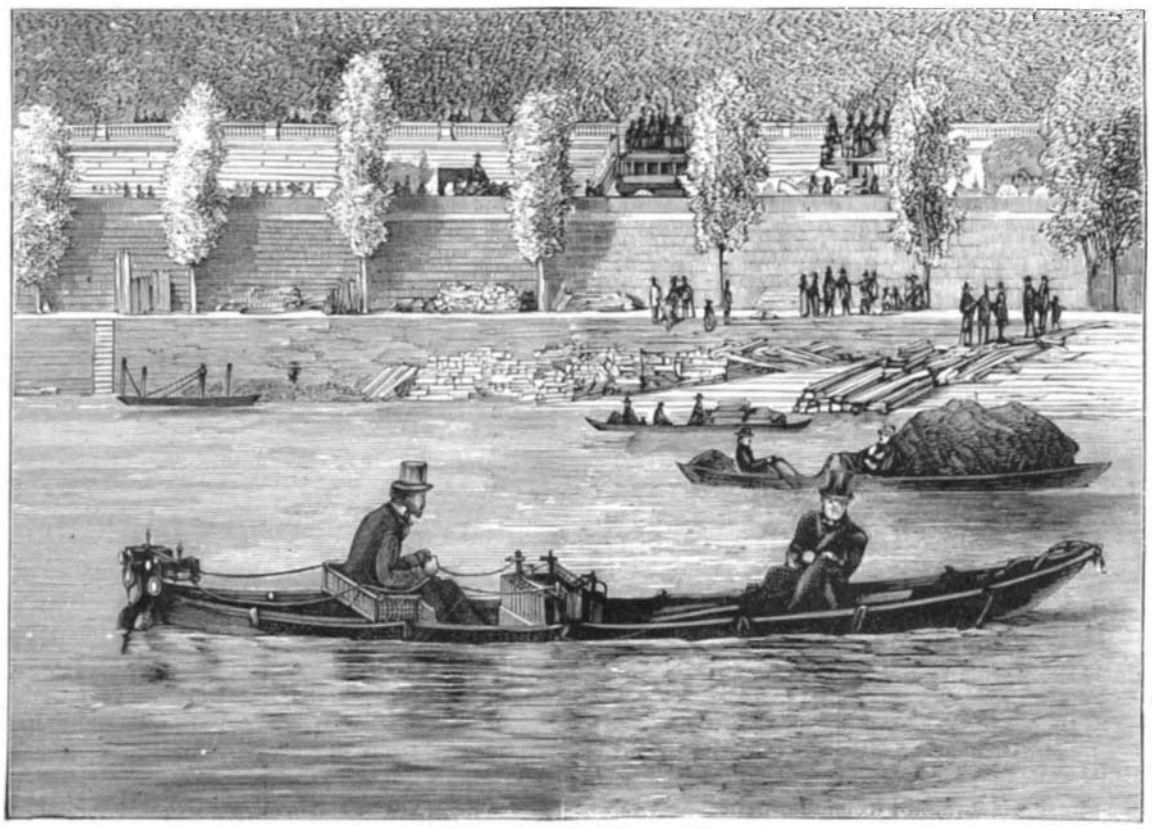
Large Flagstones.

It is said that the largest flagstone ever cut was laid in Chicago before the great fire. It measured 16x25 feet and was 12 inches thick. Lately one 15x25 feet was cut at Waterville, Oneida County, N. Y., and $5,000 have, it is said, been offered for it delivered in this city. The problem is to get it here, since it is too wide to pass railway bridges and tunnels, and would be too high if turned on edge. Equally great are the difficulties encountered by way of the Erie Canal.

Experiments with Binoxide of Hydrogen.

M. Paul Bert, who, in spite of his election into the French Chamber, continues his scientific experiments, found some time ago that oxygen gas at a certain degree of pressure had the property of destroying all kinds of organized ferments, while it was without action on the chemical ferments of the saliva and the pancreatic fluid.

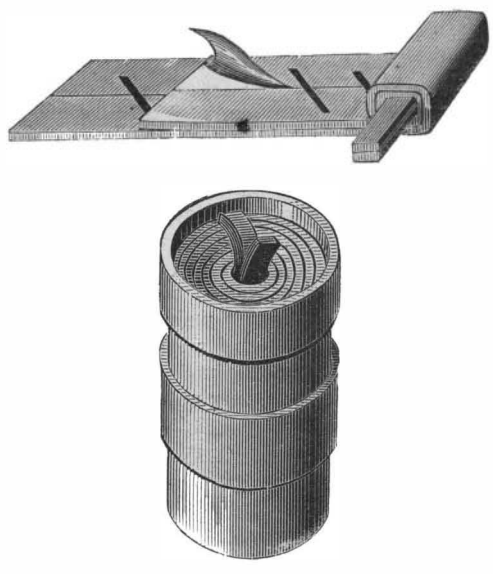
A young French chemist, M. Paul Regnard, has recently renewed these experiments, but instead of using compressed oxygen gas, he has employed binoxide of hydrogen, that is to say, distilled water containing one per cent of the binoxide. He has found that a few drops of this weak solution arrest the fermentation produced by yeast, prevent the production of mycoderms in wine, prevent the putrefaction of milk and white of egg, urine, and saccharated yeast, but have no preventive action whatever as regards the sugar-producing properties of the ferments of saliva and the pancreatic fluid when acting upon cooked starch.



THE ELECTRIC BOAT

THE FAURE BATTERY—STORED-UP ELECTRICITY.

The current number of *Le Journal Universel d'Electricité* contains, says *Engineering*, a very ably written article by M. Frank Géraldy upon the Faure secondary battery, to which we recently referred. From this article we find the space to make the following extracts: "The posters bearing the words 'Power and Light' in enormous letters, are still visible on the walls; the noisy articles that have appeared in certain journals are not yet forgotten; however, the bills are beginning to disappear, the effect of the articles to decrease, excitement is on the wane, and the scientific press can at last be heard. It has, indeed, been difficult to discuss this matter sooner, for it was essentially necessary to have data and information as exact as possible, and these have not been obtained without trouble."



THE FAURE BATTERY.

The author then refers briefly to the secondary battery of M. Reynier, and proceeds to describe the Planté battery, which he states to be almost identical with that of M. Faure, M. Planté having, except in one point, long ago anticipated what M. Faure has recently brought forward, and which has been received with so much popular excitement. He then continues: "We will now proceed to the Faure secondary battery. It is protected by two patents dated October 20, 1880, and February 9, 1881, respectively. In these patents M. Faure describes principally those batteries composed of lead plates laid on frames covered with red lead, and protected by leather, attached by means of lead rivets, an arrangement similar to the rectangular batteries of M. Planté. The actual batteries are not so made, being constructed as follows: Two sheets of lead are taken 7·87 inches wide; one of these plates is 23·62 in. long, and 0·04 in. thick; the other is 15·75 inches long and 0·02 inch thick. Each plate is covered on both faces with a layer of red lead reduced to a paste by water, 1·76 lb. being spread over the larger plate, and 1·54 lb. over the smaller. On each face thus prepared a sheet of parchment paper is placed, and the whole is introduced into a sheath of thin leather. One plate is then put on top of the other and rolled up, strips of rubber being interposed obliquely, as shown in the sketch. The roll is then placed in a cylindrical lead cell, the outside of which is strengthened with copper bands, and the inside covered with red lead and leather, so as to increase the useful surface of the battery. The latter then presents the appearance shown in the sketch, and one of the projecting stems from the lead plates is bent over and soldered to the inclosing cylinder, which is ready for use when it has been filled with water with about 10 per cent of sulphuric acid. The apparatus when charged weighs about 20 lb. It will be seen that this differs from the Planté secondary battery only in the employment of red lead. The material chiefly employed is the same, the mode of construction is precisely similar, the leather takes the part of the cloth previously used by M. Planté; it has no merit in itself; on the contrary, it is a cause of resistance, and is liable to deterioration, being useful only to keep the red lead in place. It is, in fact, this red lead which constitutes the new feature, and gives the special advantage to the apparatus.

"According to the inventor there are two advantages gained. The long and delicate operation necessary to prepare the Planté battery is not required. (This operation consists in passing through the battery an electric current,

* In a note lately presented to the Academie des Sciences, M. Trouvé claims to have improved the Siemens armature. The poles, instead of being portions of a cylinder whose axis coincides with the axis of the system, are so turned that they gradually approach their surfaces to the magnet until the moment when the under side escapes from the influence of the magnetic pole, and the repulsive action commences. By this device, the point of total rest is practically avoided.

M. Trouvé adds that they proved this by constructing two Siemens armatures of the same diameter, one of which he modified in the above manner. He used them successively in an electric motor, and with the same pile he obtained a much greater working power from the modified form. More ample details may be found in "Comptes rendus des Séances de l'Academie des Sciences."

when oxygen goes to one plate, and produces a thin coat of peroxide of lead, and hydrogen goes to the other plate.) The second advantage claimed is that the battery has a storage capacity much greater than that of Planté; the proportion, according to M. Reynier, being, as deduced from numerous experiments, forty times greater with equal weights of batteries. The first advantage claimed may be readily conceded, and it is one of considerable practical importance and value. The second cannot be admitted, as will be seen from what follows. M. Hospitalier and myself were very desirous to subject the Faure battery to precisely the same tests that we have made with the Planté battery.

"To do this we first addressed ourselves to the proprietors of the invention, who replied that they could not intrust us with the apparatus; that they would not object to trials, but only after some time. Since this communication we have heard nothing from them. In the absence of direct data we will reason on the figures supplied, and the experiments made by the proprietors of the Faure battery before the public. It has been said and repeated officially that in a Faure battery weighing 165 lb., there could be stored up a quantity of electricity able to produce an effort equal to one horse power, for one hour, or 3·28 foot-pounds per second and per pound of battery. We have only seen the apparatus producing power, on one occasion, at the Société d'Encouragement. Then it was far from giving this result; the battery weighed 326 lb., but instead of giving 1,070 foot pounds per second it only gave 339 foot pounds. The apparatus might have been working under unfavorable conditions; it might have been doing far less than its maximum. We do not wish to draw any deductions from this experiment, which was, however, a very unfortunate one, and we will for the moment accept the 3·28 foot pounds per pound of battery. We ought here to examine what is the duty of the apparatus. In reference to this M. Reynier made before the different societies an algebraical calculation which is published in the Transactions of the Academy. This calculation was met—at the Société de Physique—by many reasonable objections, the principal one being that it was useless, the only conclusion M. Reynier having drawn from it being that the more slowly the battery was discharged the better results that it gave, but no algebra was required to prove this. It is a general characteristic of the Planté secondary and of some primary batteries, as well as of dynamo machines. By using the battery very slowly, therefore, its duty is claimed to be 80 per cent, and as this proportion may be true of the Faure as well as of some other batteries, we will accept it. Admitting then this 80 per cent, 11,800 foot pounds of actual work per pound weight of battery would represent 14,750 foot pounds stored up within the battery. This figure is, up to a certain point, confirmed by an experiment made at the Société de Physique, where eight batteries, maintained, at a red heat during one hour and forty minutes, a platinum wire 13 feet long and 0·048 inch diameter. M. Reynier calculated that the total calorific work (interior and exterior) was equal to 253 foot pounds per second, or 1,518,000 foot pounds in all. According to M. Reynier, the weight of the batteries was 123 lb., so that the power stored up was equal to 12,341 foot pounds per pound of battery. There must have been a slight error here, because, as we have already seen, the useful weight of each battery cannot at the lowest estimate be less than 176 lb., giving a total of 140·8 lb., or 10,840 foot pounds per pound. According to the careful experiments we have made the useful storing power of the Planté secondary battery is 11,350 foot pounds per pound of battery, so that according to the different weights taken, the ratio of the latter to the former is 1·30, 1·08, or 0·95. This is a very long way off the forty times of M. Reynier. That gentleman, informed of this great difference, objected that the Planté battery we had employed must have been an exceptionally good one; those from which he had deduced his comparison had been furnished to him by M. Breguet. If this was the case these Planté cells did but little credit to the renowned maker who supplied. Besides, as a matter of fact, the batteries we experimented with were taken from those made by M. Planté for sale for medical and other purposes. Moreover it must be remembered that there are at present no Faure batteries made for sale, the ones already produced having been made by M. Faure's own hands or under his directions, and it is only just to institute a comparison between the Faure battery made by M. Faure, and the Planté battery made by M. Planté.

"The results we have given cannot be far from the exact truth; *a priori* there can be no reason why a battery in which the red lead is spread by hand, should be, weight for weight, superior to an apparatus in which the peroxide is furnished gradually by electricity, and experiments entirely confirm this deduction. The Faure battery is better adapted for industrial purposes, it has more solidity, and can, moreover, be made of larger dimensions; but these advantages might be obtained with the Planté battery if desired; the Faure cell does not require a preliminary electrical process to render it fit to receive the charge, which is a very great advantage, and besides it offers greater resistance for an equal surface, while it is less liable to damage than the other apparatus. But although the Planté battery has been in existence since twenty years, no one has ever suggested its employment as a means of producing power and light, and for several very good reasons, of which we will mention only one—that of transport—which has been treated in the company's prospectus as a detail of insignificance, and referred to only as it were in an excess of scrupulous minuteness.

"In order to furnish a force equal to one horse power during ten hours, ten batteries weighing 165 lb. each must be employed. This is throwing out of consideration the fact that a part of the charge only can be utilized on account of the fall of the potential below the necessary point, which would take at least 25 per cent off its utility. Making no allowance, however, for this, 1,650 lb. would have to be carried twice, that is to say, 1½ tons of battery would be transported daily, besides all other expenses, for a charge of 10 francs a day; we leave the reader to draw his own conclusion. In fact, to maintain that this mode of electrical distribution is more economical than by wires, where they can be used, is to maintain that the present system of distribution of water involves the sinking of an enormous capital in buried pipes, that in these pipes there is always a considerable loss, and that it would be cheaper to substitute a house-to-house system of water transport by means of improved barrels. But this is a point we do not press; it belongs to commerce, not to science, and this journal has nothing to do with money interests. But science suffers much from enterprises of this kind, it scares away confidence from serious undertakings, and exaggerated promises unfulfilled create the utmost distrust in subsequent undertakings of a cognate nature; the public not having obtained what they looked for turn away and refuse to have anything to do with more modest but useful applications which are offered to them. Will it not be thus with the Faure apparatus? The experiences obtained have much interest. The inventor mentions in his patents various special applications, especially for tramways, for which the battery may have a useful future. But why does not the inventor confine himself within the limits of possibility?

"Whatever future may be in store for it, we are at least indebted to it for having drawn special attention to the study of electrical accumulators. Since the announcement of the Faure battery, we know of four others in course of development, all of them of novelty and interest, and all promising a useful though less ambitious future.

"M. Reynier, at the last séance of the Société de Physique, remarked sadly that he did not ignore the relative imperfection of the apparatus he represented, but both M. Faure and himself had been unable to complete them themselves before bringing them before the public, and he trusted soon to be able to show far better results than those given up to the present time. It is an unfortunate position for a man of science to find himself exhibiting and praising without restriction an apparatus of which he sees and acknowledges the shortcomings; it is, in fact, a false position, and one which he would do better to avoid."

Roofing Slates.

Ten years ago the roofing slate industry in this country was not considered of sufficient importance to receive even a bare mention among the "special industries" of the census reports. Last year the capital invested in the manufacture of roofing slates in this country amounted to more than $8,000,000. Over 3,000 men were directly employed producing 600,000 "squares," or sufficient to cover 60,000,000 square feet. The quantity produced in the several States having slate quarries was:

Maine, 60,000 squares; Vermont, 130,000 squares; Pennsylvania, 320,000 squares; New York, 10,000 squares; Virginia and Maryland, 20,000 squares; other localities, 60,000 squares.

The Pennsylvania quarries, which produce more than half the slate turned out during the year, have been worked about 15 years. The largest quarry was opened in 1865. It contains 60 acres, gives employment to 200 men, and produces 40,000 squares a year. The most durable slates are those from Southern Pennsylvania (Peach Bottom) and the Maine slates. The latter rival the best slates of Wales. The dark blue or blue-black slates are most durable. The fancy colored slates—green, purple, red, variegated, etc.—do not hold their color. Red slate is most expensive: during the past season from $7 to $9 per square. The Peach Bottom slates have ranged from $5.50 to $6 50; Maine slate, $5.50 to $7.75; common Pennsylvania, $4.50 to $5.25; Vermont purple, $5 to $5.50; green and variegated, $3.50 to $4.50.

Elastic Adhesive Plaster.

Dr. W. P. Morgan, in a communication to the *Boston Medical and Surgical Journal*, states that he has been trying to obtain an elastic adhesive plaster, that when attached to the skin it should yield to the movement of the muscles and parts beneath it without the sensation of stiffness or an uncomfortable wrinkling.

Not being able to obtain an article of this description, I procured some India-rubber, and giving it a coat of plaster, such as is recommended in Griffith's Formulary under the name of Boynton's adhesive plaster (lead plaster one pound, rosin six drachms), I found the material I wished. After using it as a simple covering for cases of psoriasis, intertrigo, etc., I extended its use to incised wounds, abscesses, etc., and found it invaluable.

Placing one end of the strip of the plaster upon one lip of the wound, and then stretching the rubber and fastening the other end to the opposite lip of the wound, I had perfect apposition of the severed parts, the elastic rubber acting continually to draw and keep the parts together. When I have been unable to get the sheets of rubber, I have used the broad letter bands (sold by stationers) by giving them a coat of the plaster.

Correspondence.

Iridium.—A Letter from Mr. Holland.

We have received from Mr. John Holland, of Cincinnati, a small section of a small bar of iridium, cast by his new process, which we lately described in the SCIENTIFIC AMERICAN. Here is a metal that looks to the eye like polished steel, but is heavier and harder than steel, will not rust, and is not affected by the ordinary magnet. It seems destined to occupy in the near future a very important place in the arts. Mr. Holland writes us as follows:

To the Editor of the Scientific American:

As you considered my discovery of a cheap and effectual manner of melting iridium worthy of several editorial notices in my old favorite paper, the SCIENTIFIC AMERICAN (I have been a subscriber for it since 1858), I take the liberty of presenting you with a specimen of the metal, which please accept with my compliments. This specimen I broke off from a bar 12 inches long, which was cast in an open ingot. The ore was Russian, which I find softer and less refractory than the California iridium; still I have melted all kinds of the ore, and made it run about as free as silver. I use a common draught furnace and a Hessian crucible.

I will add that I have spent over $10,000 in money and been twenty years experimenting almost daily on this metal trying to melt and mould it. I now feel thankful that I have lived to accomplish it in a thorough and practical manner. The quantity of the ore is quite large in Russia and in California.

I hope soon to see it extensively used in the mechanical arts. It is very hard, will not oxidize, and is not magnetic.

I have kept one piece of it, 8 dwts. in weight, on the negative pole of a dynamo-electric machine for five weeks. There was no loss in weight, and had it not met with an accident by falling while hot it seemed likely to last for a long time. The light produced was white in color, and as the iridium is a good conductor of electricity the light was fully one-third stronger than the lamp made with both poles of carbon.

Thanking you for your kindly notices, I beg to say that I feel more satisfaction in the realization of the benefits this metal will be to the mechanical world than for any money I may make by it.

JOHN HOLLAND.

Cincinnati, June 18, 1881.

The Pursuit and Destruction of Icebergs.

To the Editor of the Scientific American:

From accumulated observations during many years past there is reason to anticipate an unusually heavy flow of icebergs along and obstructing the steamship commercial zone of the Atlantic Ocean as the summer advances. During the last year, 1880, the iceberg drift was reputed to have been almost unprecedented, and in repeated instances marine disasters have been attributed to that cause. The severity of the recent winter throughout the high northern latitudes would seem to strengthen the apprehension of their impending recurrence. Recently in connection with the subject of Arctic exploration, I have suggested that when a ship becomes beset by ice floes and icebergs, torpedoes should be employed, charged with dynamite and other explosives, and in cases of urgency the artesian auger resorted to for the purpose of rending and demolishing formidable icebergs to, set ships free from their fatal embrace.

Considering the transcendent importance of a safe route of ocean transit, it would seem expedient that the great commercial powers should co-operate in the employment of explosives and every other resource of modern engineering to free the ocean of these leviathans of the Arctic zones. The pursuit would, perhaps, prove a pleasant recreation, stimulating the ambition of the gallant sons of the sea.

June 17, 1881. DANIEL RUGGLES.

Three Horses Abreast.

The American Express Company has introduced into New York the system of harnessing three horses abreast, after the fashion of the London omnibuses. The change has been made on two of the wagons for an experiment, with very satisfactory results. The wagons are supplied with two poles instead of one, and each of the three horses is attached to a separate whiffletree. This is found to be a decided improvement over the system sometimes used of putting one horse in shafts and another at each side. The harnessing is practically the same as with two horses, with two poles instead of one. The experiment is tried upon the wagons that deliver goods in the upper part of the city, not only because the loads are frequently too heavy for two horses, but to enable the drivers to make up for lost time with an increased rate of speed, when from any cause they are delayed at the start.

Alligator Leather.

The rapid increase in the demand for alligator leather in Europe makes it possible that alligator farming may become an important industry in our Southern swamps. The foreign demand already amounts to many thousand hides a year. The tanning of alligator hides began about twenty years ago. At first Louisiana furnished the skins and New Orleans was the center of the traffic. The general slaughter of alligators soon made them scarce in that State and now Florida is the chief source of supply. The tanning is done here at the North.