first question be, "Are you happy?" With what breathless suspense shall we await the answer, and if it should be—as it is quite probable it might be—"NO!" how gratified we shall all feel that the benevolence of the Creator has not left this world alone in its misery. It would almost make this planet explode with envy should the reply be "Yes."

MACFIE THE IRREPRESSIBLE UPON PATENT LAW.

Even the London *Spectator*, which supports Mr. Macfie in his opposition to the patent laws, gives that irrepressible gentleman little credit for skill in argument, and acknowledges that very much of what he has said only tends to show defects in the present English system of patents, rather than any good reason for its abolition.

Not content with making absurd arguments and illogical speeches, Mr. Macfie has collected into a volume, speeches, papers, and expressions of opinion, which he no doubt considers as "*squelchers*," but which sensible, sober thinkers are prone to denominate as the most unmitigated bosh.

The only logical conclusion to which this gentleman's arguments tend, is one which he is too short-sighted himself to see, namely, the utter renunciation of individual rights to the possession of property, be the same patent rights, copyrights, or anything else that men are now able to procure for themselves by virtue of genius, tact, and industry.

In that Utopian state of society for which some long, and fewer hope, when every man shall live solely for the good of all men, when land, chattels, wives, and children shall become common property; when all selfishness shall be done away, and each shall prefer to see his neighbor enjoy, rather than to enjoy the fruit of his labor himself, Mr. Macfie would find the principles he advocates precisely the thing.

To suppose, however, that in the existing state of human society men will consent to relinquish their rights to property in thought, or the results of their mental toil, and allow a distinction to be made between these rights, and those by which they hold the results of physical toil, is to suppose them on the average, to be as incapable of drawing a logical conclusion as Mr. Macfie himself; a state of general imbecility we are unprepared to admit. Of course everybody would be free if there were no laws of any kind. We should then have free trade, free stealing, free murder, free starvation, and a host of other freedoms which men have thought it wise to resign for another kind of freedom, *i. e.*, freedom to go and come unmolested, to accumulate wealth, and to improve their bodily and moral condition.

In Mr. Macfie's code carried out logically to its conclusion, A may plant and cultivate a hill of potatoes, which, as soon as he has dug them, all the other letters of the alphabet may seize and appropriate, provided there is enough to go around. True, A is compensated for his loss by the right to invade the onion patch of any other letter, and devour turnips wherever he finds them growing. Thus we get back to the old original savage game of grab. It will not take long for B to find out that he is stronger than A or C; nor long for A and C to find that their chances for either potatoes, onions, or turnips, are small and slim when B is around

No man would get pay for anything he might do, but would live, if he lived at all, by stealing, unless, as we said above, each would work for all, and uniform distribution were secured, a thing which even the early Christians found difficult, as we learn from "Acts," the widows were neglected in the daily distribution.

We believe in neither Mr. Macfie nor his logic, and the logic of the *Spectator* is little better when it says:

"One of the most serious considerations with regard to the Patent Laws is that they are already being removed in other countries, and that the competition to which our manufacturers will thus be exposed must embarrass them in their business, while reducing the value of patented inventions. Mr. Macfie gives us a message from Count Bismarck to the North German Parliament, recommending the total abolition of patents throughout the new Confederation. The Second Chamber in the Netherlands passed a similar resolution by 49 ayes to 8 noes. It has already been found in some remarkable instances that countries restricted by patents cannot hold their own against others in which manufacture is unimpeded. M. Chevalier tells us that France cannot export Bessemer steel to Prussia, and that the French makers of velvet suffer in like manner from Prussian competition. The history of the aniline dyes discovered by Professor Hofman, but patented by others, teaches the same lesson. French manufacturers who had to pay £40 a kilogramme for what cost only £12 out of France, flocked by shoals from their own country and set up new factories in Switzerland and Belgium. The danger to every trade which is weighted by patent restrictions becomes the more formidable as those restrictions are removed in other States."

Let England adopt a wise protective system, and the policy of other European nations in regard to patents need not trouble her.

Uses of Mica.

Recently scales of mica have been used for spectacles and in optical instruments. The chief use in this country is in connection with stoves, and it is now quite an article of commerce, especially in New England. Many furnace doors are now supplied with small holes closed with mica, which serve as windows to enable the engineer to see the state of the fire without letting in a blast of cold air by opening the door. Many varieties of mica abound in curious markings, which have attracted the attention of microscopists as affording some clue to the true origin of this stone. Mica is one of the constituents of granite, and contains potash, and sometimes lithia and other alkalies. Stove dealers are the chief consumers of this article.

PATENT RIGHTS IN CONGRESS.

Our readers will probably recollect—as we noticed it at the time—that President Grant's first veto was that of a bill to extend the patent of Rollin White, the inventor of the Smith & Wesson revolver. We have never had a doubt that the veto was a righteous one.

In the House of Representatives on Wednesday, June 22, the bill was reconsidered, General Butler supporting its passage over the veto of the President; whereupon Mr. Farnsworth accused General Butler of having received $2,000 for his support of the measure. General Butler retorted that the charge was false, malicious, and infamous, and stated that the $2,000 received by him were counsel fees, received in a case tried before the Supreme Court, the brief in which cost him four weeks' work. He considered the money honestly earned, and doubtless so will the public.

The Joint Committee on Retrenchment lately directed to investigate settlements by the Navy Department of contracts made by Isherwood, Chief of the Bureau of Steam Engineering under the last administration, for steam machinery, held a meeting on the evening of the 22d June. No witnesses were examined, but the Hon. William E. Chandler was present by invitation, and in reply to a question he stated that he knew nothing personally of the settlements, but acted as the counsel of Henry W. Gardiner and others, in their efforts to defeat an extension of the Corliss patent and in the preparation of papers placed before the House Appropriation Committee, to defeat an appropriation to pay Corliss' certificate, given by G. W. King, the present head of the Steam Engineering Bureau, in settlement of contracts with the Corliss Steam Engine Company, of Providence, R. I. This Company had contracts unfinished when the present administration came into power. A settlement was made, by which engines began were left unfished, the Department agreeing to pay some $250,000.

USES OF FLUOR SPAR.

In an article on fluor spar as a flux, Vol. XXII., page 288, we stated that in the manufacture of iron, "the proper proportion is about 50 pounds to 100 pounds pig iron, or 40 pounds to 100 pounds spiegel iron." In both of these cases for 100 pounds read 100 *centners*—this makes the proper proportion 50 pounds fluor spar to 11,000 pounds pig iron, or 40 pounds to 11,000 pounds spiegel iron.

FLUOR SPAR IN GLASS MANUFACTURE.

E. Richters, in Waldenburg, Germany, states that the substitution of fluor spar for lime in the manufacture of glass allows of a great reduction in the amount of glauber salt, and greatly promotes the melting of the frit.

As the result of numerous experiments conducted on a large scale, he found that with the same consumption of fuel and similar length of time, the amount of glauber salt required could be diminished one half by substituting fluor spar which had previously been pulverized and calcined for the lime usually employed.

In countries where fluor spar can be had in abundance, its introduction into glass manufacture would appear to offer many important advantages. The following are the proportions taken:

With fluor spar.		With lime.	
Sand	115·44 lbs.		116·40 lbs.
Fluor spar	27·69 "	Lime	15·55 "
Glauber salts	4·90 "		8·00 "
Manganese	4·00 "		3·00 "
Charcoal	2·00 "		2·00 "
Glass frit	299·00 "		248·00 "

A Warning to Thieves.

The *Journal of Commerce* notices with astonishment that bank officers, who pay such large sums for safety vaults, burglar-proof locks, steel-lined chests, and all the other very proper protections against robbery, neglect to add one of Holmes' Electric Alarms. With this, well arranged, a gong might be set ringing on the first opening of the door or window of a banking house, making sufficient noise to waken a whole village. Mr. E. Holmes, whose office is at No. 7 Murray street, showed us recently a large gong that he had arranged especially for bank alarms. Some banks in this city are protected in this manner. It is well worth the attention of those interested, and we write solely for their benefit from our own knowledge and experience, without any solicitation from the owners of that invention.

A New Use for Oxygen.

We are informed by M. Widemann, who is connected with the works of the New York Oxygen Gas Company, that the use of oxygen in renewing and increasing the flow of oil in petroleum wells, has been so successful that a regular trade has sprung up in oxygen gas for this purpose. The gas is injected into the wells through tubes, and mingling with the hydrocarbon vapors, forms an explosive mixture which, when ignited, completely opens seams which have become clogged, and thus renews the flow.

COMPRESSED FISH OFFAL FOR MANURE.—In a recent article upon the uses of codfish the compressed offal was spoken highly of as a manure. Mr. W. F. Rickard, F. C. S., formerly of London, writes us from Leviathan Mine, Cal., that he is the inventor of the process therein described as French. He further writes that the compressed offal does not decompose by exposure to the air. Samples which had been lying about his London office four years have been found perfectly hard and sweet, proving thereby that the article may be exposed in bulk without the cost of packages.

COCKROACHES can be destroyed by using smooth-glazed china bowls, partially filled with molasses and water. Set the bowls against something by which the insects can get in; they will not be able to get out.

PATENT OFFICE AFFAIRS.

The business of the Patent Office is now in a flourishing condition, and the present is a favorable time to enter applications. Inventors will find the SCIENTIFIC AMERICAN PATENT AGENCY ready to attend to the prosecution of claims with the greatest dispatch. By reference to our register, we find that we have made upwards of twenty-four thousand preliminary examinations into the novelty of alleged new inventions. This great experience, together with the fact that a large proportion of all the business with the Patent Office, for the past twenty years, has been conducted through this Agency, suggests to inventors the surest and best means to secure their rights.

We give opinions free, and all we require is a rough sketch and description of the invention.

Inventions patented through this Agency receive notice in the SCIENTIFIC AMERICAN.

MODELS.—In order to apply for a patent the law requires that a model shall be furnished, not over a foot in any of its dimensions, neatly and substantially made. Send the model by express, prepaid, addressed to Munn & Co., 37 Park Row, New York, together with a description of the operation and merits of the invention.

CAVEATS.—Whenever an inventor is engaged in working out a new improvement, and is fearful that some other party may anticipate him in applying for a patent, it is desirable, under such circumstances, to file a caveat, which is good for one year, and, during that time, will operate to prevent the issue of a patent to other parties for the same invention. The nature of a caveat is fully explained in our pamphlet, which we mail free of charge.

EUROPEAN PATENTS.—Probably three-fourths of all the patents taken by American citizens in Europe have been secured through the SCIENTIFIC AMERICAN PATENT AGENCY. Inventors should be careful to put their cases in the hands of responsible agents, as in England, for example, the first introducer can take the patent, and the rightful inventor has no remedy. We have recently issued a new edition of our Synopsis of European Patent Laws.

All communications and inquiries addressed to Munn & Co., respecting patent business, are considered as strictly confidential.

THE REPORT OF COL. W. A. ROEBLING, CHIEF ENGINEER OF THE N. Y. BRIDGE CO.

The Superintendent and the Chief Engineer of the N. Y. Bridge Company, who have in charge the erection of the great suspension bridge over the East River between New York and Brooklyn, have made their reports. That of the Superintendent, Mr. W. C. Kingsley, pertaining chiefly to the financial matters, we shall pass without special notice. That of Col. Roebling, however, is so interesting and instructive, and the work is of such importance, that we make room for nearly the whole of his report, omitting only some introductory matter.

SURVEYS.

The general line, known as the Park route, had before been determined, but no actual line had ever been located upon the ground, the bridge line having been simply traced upon the largest and best maps procurable of both cities.

WORK WAS COMMENCED

in June, 1869. One single air line run through over the tops of the houses from the City Hall, in New York, to St. Ann's church, in Brooklyn, at once showed a discrepancy of more than fifteen feet between it and the line laid down on the maps. Several center lines were run on trial, each a little further to the east on the Brooklyn side and more to the west on the Chatham street, New York side, until one was found that was satisfactory.

In the location of bridges some attention is paid to the difficulties likely to be incurred in getting foundations for piers, in making approaches, etc., but here such consideration had to be ignored, and the towers and anchorages placed wherever the exigencies of the case brought them. The charter fixed the terminus on the Brooklyn side in the square on the corner of Sands and Fulton streets, etc., and on the New York side it was desirable to bring it as nearly as possible to the corner of Nassau and Chatham streets. The foundations of the Brooklyn tower threatened to encroach upon one of the main slips of the Fulton Ferry unless kept far enough to the east, but by doing so the New York tower unavoidably occupied one of the slips of the Roosevelt street ferry. Any further movement to the east would bring the approach over Prospect street to a point where no head room was left between the grade of the street and the bridge crossing it. The same was true in regard to North William street.

Other difficulties summed up showed that no change from a straight line was admissible. The center timbering established a minute and detailed survey. Since then the Brooklyn foundation has been placed in its proper position on this line, and any change is impossible.

In August, 1869, I was appointed Chief Engineer. At the first meeting of the Board of Directors, in September, 1869, the Executive Committee were empowered to proceed with the foundation of the Brooklyn Tower, and to complete the same up to high-water mark. Mr. Horatio Allen was appointed Consulting Engineer, and Mr. Wm. C. Kingsley, General Superintendent. To Messrs. Webb and Bell the contract to built the caisson was given.

THE BROOKLYN FOUNDATION.

In the meantime a boring made in 1867 showed gneiss rock at a depth of 96 feet below high water. The strata penetrated consisted in the first place of surface filling through alternate layers of hard pan and boulders of trap embedded in sand and clay. Below 50 and 60 feet depth the material was so compact that the bore hole stood without tubing for weeks. No necessity existed, therefore, for going down to rock; a depth of about 50 feet would suffice. But the great desideratum to be attained was a uniform character of the soil over the whole space of the foundation whatever the depth might be. It is well known that the drift formation of Long Island presents a great variety of strata in comparatively short diagonal distances Within a hundred or two feet on either side of this foundation, there is no bottom so to speak, and piles are driven a great depth into mud; whereas in the center of our foundation the depth of water was only a few feet

the existing ferry slip had been blasted out at a great expense, and to drive an iron-shod pile even two feet into that material was the work of hours. This hard material, however, occupied only a part of the foundation, which comprises an area of 17,000 square feet. One third of the area towards the east was much softer in character; to meet the requirements of the case a heavy solid timber foundation was decided upon, of sufficient thickness to act as a beam, and having the requisite mass to insure a uniform settling. The importance of a uniform foundation becomes evident at a glance when we consider the size of the tower, weighing 35,000 tuns, with a hight of three hundred feet above the foundation upon which the permanent pressure is 4½ tuns per square foot. In addition, the buoyancy of the timber enables us to dispense with the screws ordinarily used in towing a caisson.

In regard to durability, it is well known that timber immersed in salt water is imperishable, and to protect it against worms it is merely necessary to sink it beneath the river bed. It at once suggested itself to make the timber platform as far as possible a part of the

CAISSON.

This has been done by making the roof of the caisson a solid mass of timber, of fifteen feet in thickness. The object and purposes of a caisson in sinking a pneumatic foundation is too well known to need any description here; it is merely a diving-bell on a vast scale. It may well be said that, since the unparalleled achievement of Captain Eads, at St. Louis, the word caisson has become a household word among American engineers.

The caisson of the East River Bridge is a large inverted vessel or pan, resting bottom upwards, with strong sides. Into this air is forced, under a sufficient pressure to drive out the water. Entrance is had to the large workingchamber, thus formed underneath, through suitable shafts and air-locks. The material is taken out through water shafts, open above and below, and two supply shafts send down the material subsequently needed for filling up the air chamber.

The dimensions of the caisson are rectangular; length, 168 feet, width, 102 feet, hight 9 feet 6 inches. Thickness of roof, 5 feet. The sides form a V, and are 9 feet thick where they join the roof, sloping down to a round edge. The inner slope of the V has an angle of 45 degrees. The lowest part of the slope is formed by a semi-circular section casting, protected by a sheet of boiler plate, which extends up three feet each side. A heavy oak sill rests on the casting, and it consists of a stick nearly two feet square. The three succeeding courses are laid lengthwise, after that the alternate courses are heading courses. The whole mass is thoroughly bolted together by drift bolts, screw bolts, and wood-screw bolts. In addition there are heavy angle irons uniting the V to the roof. At the corners the courses of timber are halved into each other, and strapped together for further security. The roof is composed of five courses of twelve-inch square yellow pine sticks, laid close together, bolted sideways and vertically, and having a set of heavy bolts running through the five courses. The outer edge of the caisson has a batter inward of one in ten to facilitate its descent into the ground.

To make the caisson air tight, the seams were all thoroughly caulked for a depth of six inches, inside and out, and in addition a vast sheet of tin unbroken throughout, extends over the whole caisson, between the fourth and fifth course, and down the four sides to the shoe. The tin on the outside is further protected by a sheeting of yellow pine. The space between the timbers was filled with hot pitch. As air under pressure of forty or fifty pounds will penetrate wood with ease, the inside of the air chamber was coated with an air-tight varnish, made of resin, minhaden oil, and Spanish brown. The air-tightness up to the present time is quite satisfactory, and only one fifth of the air pump on hand is sufficient to keep the water out.

The yellow pine timber was selected specially for the purpose. It came principally from Georgia and Florida, and much of it was so pitchy that the sticks would not float. The average specific gravity of all the timber was 48 degrees per cubic foot. Every bolt hole is bored with a large drift to insure the hold of the bolts. As the construction of the caisson proceeded, the iron work of the water-shafts, air-lock shafts, and supply shafts was put in. This work was done under contract by Messrs. Hubbard & Whitaker, of Brooklyn.

The water shafts, two in number, are square shafts, three eighths boiler plate, properly stiffened by angle irons, and well secured to the caisson. They are seven feet by six feet six inches, and are open above and below, the lower edge extending twenty inches below the edge of the shoe. The water inside of them rises and falls with the state of the tide outside. The material to be taken out is shoved under the edge into the water shaft by the laborers inside, and is then taken out by the so-called clamshell dredge of Morris & Cummings, of New York—the only known instrument which possesses the precise action of the human hand in picking up things. Any other arrangement for excavating in the shape of a revolving dredge or a sand pump was out of the question. The air shafts are 3'6 feet in diameter, and extend simply through the timber on top of which the air locks are placed. The supply shafts are two inches timber, twenty-one inches diameter, and of indefinite length—they have a door at the bottom and one on the top with an equalizing pipe. They are filled full of made air, and the whole contents fall into the air chamber below.

It was the original intention to have made the air chamber under the caisson one entire space without any divisions into compartments, thus facilitating the excavation of the material. Various considerations led to the abandonment of that view. Since the caisson was to be launched like a ship, a certain number of launching ways were required, and these required a stiff frame from the launching way up to the roof. Again, in the boulder soil, only a few points of the edge would have rested and supported the weight at any one time. But the chief point was the rise and fall of the tides and their effect on the caisson. The extreme rise and fall is 7½ feet. If the inflated caisson is just barely touching the ground at high water, it will press upon the base with a force of 4,000 tuns at low tide, all of which has to be met by the strength of the shoe and the frames. And it is not until the caisson is permanently righted down that the continuous excavation can take place inside. The frames are proportioned somewhat to the strains in launching, and form a heavy truss of pine posts and stringers with three-inch sheathing on each side, and side braces to the roof every six feet. The ends of the frames are secured to the sides of the V by knees.

It was concluded to limit the pressure of the caisson during the launch to 2¼ tuns per square foot of launching surface. This required seven ways in all, two under the edges and five under the frames. The total launching weight of the caisson was 3,000 tuns, containing 111,000 cubic feet of timber and 250 tuns of iron. It was launched sideways—that is, with the long face of 168 feet by 14 feet 6 inches high facing the water. The ground-ways were laid at an augle of one inch per foot, the caisson standing fifty feet back from the end of the ways. To buoy up the forward end of the caisson as it entered the water, and thus prevent its entire immersion, a temporary water-tight compartment of two-inch plank was put in, one third the distance across. It served its purpose admirably. A full complement of wheel barrows, crabs, and winches were likewise stowed away in it. The ground-ways consisted of two timbers of eleven inches square each, bolted together sideways. They were grooved like the guide of a planer, and the upper launching way fitted their grooves correspondingly. The great danger of launching so large a mass on seven ways consists in the liability one end going faster than the other, and thus wedging the caisson fast on the ways. Only the outer ways were provided with rib bands. They however, proved superfluous to accelerate the motion of the caisson as it entered the water, and thus overcome the increasing resistance. The ways were laid crowning to the amount of eighteen inches in their length. The launching ways were likewise continued ten feet back of the caisson, and provided with shoes against the sides, it was desirable that the rear edge of the caisson should leave the end of the ground ways uniformly, and not stick fast on one—a thing likely to occur, since the ways stopped at the low-water line, and the rear edge would fall at once into deep water. The above arrangement answered the purpose.

On the 19th of March, 1870, the launch took place; in every respect a success. As soon as the last block was split out, the caisson commenced to move. The impetus it had acquired in the first part of its course proved sufficient to overcome the immense resistance offered by the water. It would seem that if the ways had been about twenty feet longer, the caisson would have lost its headway. The air caught inside the air chamber aided materially in buoying up during the launch. Neither the battering rams provided to start her, nor the checks and levers intended to hold her back until the proper time, were needed. The deck of the caisson was not submerged, nor was there any wave of translation in front, as might have been expected. An air pump and boiler had been placed on the caisson before landing. This was at once set in motion, and in a few hours the water was all displaced from the air chamber, the air blowing out at one corner, thus proving a satisfactory state of tightness. When the air was afterwards allowed to escape entirely, the top of the caisson settled within seventeen inches of the water, which happened to agree with previous calculations.

The launching arrangements, as well as the entire responsibility of the launch rested with the builders, and they accomplished their results by simple common sense arrangements, no money being wasted on elaborate precautions or preparations.

PREPARATIONS OF SITE.

It had been estimated that the same length of time would be required to prepare the bed for the caisson as to build it. Owing to unforeseen difficulties, possession of the ground was not obtained until Jan. 1st, 1870. The winter had hitherto been mild, and continued so, much to our advantage; and during most winters it would have been impossible to do anything. The preparation of the site consisted in establishing a rectangular basin open towards the water side, surrounded on three sides by a wall of sheet piling leveled off to a uniform depth of eighteen feet at high water. This depth was decided upon because one corner of the side had that depth of water already, and because a certain depth was necessary to float in the caisson at all stages of the tide. The dismantling of the space—the ferry slip—drawing a hundred piles, tearing out 350 feet of fender sheathing, removing of 350 feet of heavy cribbing, filled with stone and dredging of the loose material on top, required in all about a month. The dredging was done by Mr. Tebo by day's work, two machines of the Osgood patent being used. The drawing of the piles was done partly by pile drawers and in part by the "ox," a steam crane-boat well adapted for the purpose. At the same time it became necessary to cut away half of the pier separating the foundation from the main slip of the Fulton ferry which was accomplished without interfering with the ferry. All the timber and piles taken out were found to be infested with thousands of sea worms; the ravages, however, were confined to the space between low water and the mud line. A pile which was sixteen inches in diameter below the mud, perfectly sound and free from worms, would be found eaten away to a thin stem of three inches just above the mud, and all timber was affected alike. This shows the necessity of going below the top of the river bed with our timber foundation, and also proves its entire safety in that position.

MATERIAL REMOVED.

In all, there were 10,700 yards of material removed, the bulk of it in the course of a month, comprising the filling in and surface mud. A line of soundings then taken showed 3,000 yards yet to be removed before the level of eighteen feet was reached. The character of this material was next to solid work, some of the dredges could make but the slightest impression upon it, neither the Osgood nor the powerful grapnel of Morris & Cummings. All of the old charts of the harbor showed this point to be a reef of rocks or boulders, and these had been covered by filling in from the shore. Recourse was necessarily had to powder. Surface blasts were not used at all because the locality forbade the use of heavy charges which are essential for success. A surface charge of less than three hundred pounds would have been of no effect. It was determined to make holes in the bottom by means of an iron pile driven in and afterwards withdrawn. Into the bottom of this hole say, four or five feet deep, a canister containing fifteen to twenty pounds was inserted by a diver when the pile driver was hauled back and the charge exploded by electricity. The result was a small crater and the loosening of contiguous boulders from their bed. Three iron piles were used, two of five inches and one of six inches, twenty-two feet long and shod with steel at the point and head. Two pile drivers were coupled together for this work and a double gang of laborers employed day and night under charge of Captain Scott. A week's practice reduced the matter to a system and developed the kind of canister to be used, the exploders and the battery. From the ordinary tin canister we passed to second-hand, lap-welded, wrought-iron tubes, cut in lengths of two feet and plugged at each end, which proved effective, but the supply getting scarce, recourse was had to cast-iron shell with sides one half an inch thick. They possessed the additional advantage of dropping to the bottom of the hole of their own weight. The average number of blasts made by one gang in ten hours was thirty-five. The greatest delay was experienced in withdrawing the pile which frequently resisted the united efforts of both pile drivers hauling on treble blocks with their engines, and a thorough shaking did more good than any amount of steady strain.

THE BATTERY

used was a small frictional machine, inclosed in a light rubber case, and was supplied from the Oriental Foundery, of Boston, as were the exploders. This machine was instantaneous in its effects and never out of order, and with it any number of charges could be set off at the same time. After a thorough blasting the Osgood dredge could work to advantage for a short time. Many of the boulders were too large to be picked up by a dredge, and a few were taken out by the Morris & Cummings grapnel, while others were slung under water by divers, having first been loosened by blasting and then lifted by the divers.

Those that were too heavy were floated along under water to a space back of the foundation and there dropped. The whole process was expensive, but still very effective. The casual observer, to whom the surface of the water appeared the same day by day would think that nothing was done, but the diver who slung boulder upon boulder night after night, had a different story to tell.

This driving of iron piles afforded a thorough knowledge of the entire ground. On the side towards Marston and Power a dozen blows would drive the pile down forty feet through soft clay, where it was brought up by a harder stratum. But in the center there is a ridge-shaped layer of hardpan, varying from two feet to eight feet in thickness. Frequently 100 blows of the 1,500-pound hammer were required to drive the pile three feet into this material. Towards the ferry the clay again disappeared, giving way to boulders of all sizes, packed close together, a coarse sand filling up the spaces between. On the river side all sand or clay was washed away, leaving the bare stone.

As the time passed along, all work was confined to the lines of the frames and edges of the caisson, leaving the ridges between, to be removed afterwards, from under the caisson. Three fourths of the boulders consisted of the trap rock of the Palisades, the rest gneiss, with a few sporadic boulders of red sandstone. Holes of extra depth were blasted for the location of the water shafts. In the south shaft the pile finally penetrated through eight feet of hard pan, and there struck into loose sand.

None of the dredges were adapted for such work. The bucket should have been discarded entirely and replaced by one long plow-shaped tooth, fastened to the dipper handle, solely with a view of rooting up the material The ordinary dipper presents too much surface for penetration.

The cost of dredging out the soft material on top was about sixty cents per yard, and of the hard material below, including the blasting $3'62 per yard.

1,173 blasts were fired consuming 13,000 pounds of powder.

While the dredging was going on the inclosure also proceeded—an outer row of piles was first driven and fastened back to anchors and logs, in order to resist the pressure of twenty-two feet of earth—five feet inside of this a line of close sheet piling was placed with sufficient marginal space for towing in the caisson.

During April, six air-compressing machines were placed in their foundations, and satisfactorily tested. They were manufactured by the Burleigh Rock Drill Co., of Fitchburgh, Mass. Each engine is twenty-horse power, and drives two single acting air cylinders of fourteen-inch stroke and fifteen-inch diameter. Every engine has its own boiler, and they are all so connected that the stoppage of no one boiler or engine will affect the rest.

A large condensing vessel serves to precipitate the moisture in the compressed air and deliver dry air into the caisson. A ten-inch main leads the air underground a distance of 150 feet to the caisson, where it branches, and two rubber hose of six inches diameter lead the air to the supply shafts and thus into the caisson. Self-acting clock valves prevent the escape of the air in case anything should happen to the hose. All the air conductors have been tested to a safe limit. A blacksmith and carpenter's shop have been erected, the fires being blown by compressed air. One compressor has been set apart to compress air to 65 degrees for the purpose of working two Burleigh rock drills in the caisson.

Two double engines have been setup by Morris & Cummings to work the dredges in the water shaft, and two more engines are ready to hoist and set stone on the caisson by means of three large derricks with horizontal booms, yet to be placed on the caisson.

On the first of May the leveling off had proceeded far enough to bring down the caisson from Greenpoint. A contract had been entered into in the mean time with Webb & Bell to lay the ten additional courses of yellow pine timber, and advantage was taken by them of the delay to put on two of the courses at Greenpoint, where the caisson was lying afloat.

THE CAISSON WAS TOWED DOWN

by six tug boats, under charge of Capt. Maginn. The pump was kept in operation and the air chamber fully inflated, the great buoyancy possessed by the V-shaped sides prevented any tilting or loss of air. This inflation was essential, as in one part of the river there was only a foot space between the bottom and the lower edge of the caisson. At the turn of the tide the following day, the caisson was easily hauled into place.

A double row of piles incloses it on the outside, and also supports the track and turntables for the stone cars.

By June 20th all the courses of timber were laid. The courses cross each other at right angles, with space between of actually four and five inches—every two feet four inches the stick is fastened down by a one-inch drift bolt. The whole mass is thus bound together into one solid unyielding platform. Each course was properly adzed off, and the original course of two piles with which the frames were laid is still preserved—the amount of timber laid in five weeks amounts to over 100,000 cubic feet. The space between the timbers is filled in with concrete, which serves to add to the necessary weight, as well as to harden and preserve the timber.

It is composed of four parts of clean washed beach gravel from the Sound, two of sand, and one of cement. The gravel is small, uniform in size, and perfectly free from impurities. Various brands of cements have been used so far, comprising in addition to the Rosendale cements, the yellow cements from Coplay, Pa., Akron and Fayetteville, N. Y. The latter are all quick setting, but do not attain the ultimate hardness of the slower setting Rosendale cement, especially where the latter has been ground of extra fineness by special agreement.

As the timber was built up the covers were slipped back and the outer spaces filled in with concrete, so that at its upper corner there is a mass of concrete from four to five feet thick, which serves to protect the timber.

The additional sections of water shaft as well as the air locks were put up, in the meantime permanent air connection was established. The air locks are seven feet high, and six feet six draw inside; the sides are half inch boiler plate and heads of cast iron, with oval doors eighteen by twenty-two inches; six bulls-eyes light up the interior.

These locks as well as the sections of water shaft were made by the Morgan Iron Works, and are very creditable specimens of workmanship.

To avoid the lengthening cut of the air shafts the air locks are placed within water tight compartments, which occupy the spaces of the well holes in the Towers, and will keep out the water when the top of the timber is submerged.

The air chamber was first entered May 10th through the air locks, and gradually, as the caisson settled more, the force of laboring men has been increased.

The removal of the temporary wooden compartment and shoving out of the material under the edges was accomplished in due time, as well as the opening of two doorways through each of the frames.

For three weeks past a gang of 40 men has been at work in the caisson, for eight hours every day, under charge of Mr. Young, principally in leveling off and removing boulders which happened to lie under the frames and edges. A deposit of dock mud, from two to three feet deep, has made this work exceptionally unpleasant. The dredges, which are now beginning to work, will remove it in a short time. The removal of large stone from under the shoe, some of them containing 100 cubic feet, is a matter requiring considerable skill and perseverance. It has so far been accomplished by means of blocks and falls, crabs and winches, and hydraulic pulling jacks. In extreme cases blasting will be resorted to.

During this time the caisson has daily

BEEN RISING

with every high tide and resting on the ground again at low water, requiring most of the work inside to be done at low water, where the caisson is comparatively free from water. As the edge does not readily sink into the hard soil it is expected that there will always be some water. Since the edge of the shoe is rounding, it allows the air to blow off before the level of the water has reached the lowest limit; this is caused by any trifling agitation in the level of the water inside, which gives the escaping air a chance to establish an outgoing current before the head of water inside becomes sufficiently great inside to overcome it.

By constantly building up on top the center of gravity has been raised considerably, and the caisson is now in a condition of unstable equilibrium—that is, it does no longer rise uniformly with the rise of the tide. One end will remain on the ground and the other rises as much more in proportion, and the more it rises the more surface it presents to the upward pressure of the air on that side, the general level of the water inside being governed by the level of the highest point of the shore.

This rising of one end of the caisson is attended by another phenomenon of imposing appearance. As the tide rises, and the downward pressure of the caisson is about being overcome by the increased tension of the air inside, as well as the buoyancy of the water outside, one end of the caisson will suddenly rise six inches or more. The result is that for a few minutes the tension of the air inside exceeds the head of water outside, and a tremendous outward rush of air takes place under the shoe, carrying along a column of water of hundreds of tuns to a hight of sixty feet at times. This continues until a return wave inside of the caisson checks it. These blow-offs are not felt to any extent by the men inside, beyond the warning noise and momentary draft created.

The magazine of force contained in 170,000 cubic feet of compressed air is so large that the loss of a few hundred tuns is a trifle. A system of pipes is put in the air chamber for the purpose of illuminating the air chamber with calcium lights, a trial of which has resulted favorably; with moderate pressures candles answer very well.

THE FIRST COURSE OF STONE

is now being laid. Its weight, together with the concrete on top of the timber, will probably suffice to ground the caisson permanently, and thus permit the erection of setting derricks on the caisson. The stone setting will then keep uniform pace with the excavation, and by the time the desired point is reached the masonry is far above the water level.

The stone used for these land courses, which will be permanently under water, is the Kingston limestone, furnished by Noon and Madden. These stones have both beds cut, but the sides and builds left rough, with vertical quarry joints, the projections not exceeding two and a half inches. The beds are exceptionably wide. As the base of the masonry work resting on the timber is very much larger than the section of masonry at the water level, it is considered that this class of masonry is equally as good, and certainly far cheaper than regular dimension stone. All the stone in any one course are cut to a uniform size. Above low water granite will be used on the water face, and subsequently throughout as freestone.

The first or corner stone of the extensive pile of masonry to be raised above the caisson, unlike as it was to ordinary affairs of this kind, was a massive block of limestone from the quarry at Kingston, Ulster Co., and in extent was three feet wide by eight in length, weighing about 5,800 pounds, or 165 pounds to the cubic foot; and it is of this material that the foundation below low water mark will consist.

Additional borings are now being made for the N. Y. tower. The boring made two years since was 400 feet away from the actual site of the tower. This one is directly on it. The same stratum of thirty feet of the finest quicksand has been penetrated, but boulders have been encountered at a depth of eighty feet, and the indications are that rock will shortly be reached.

Plans have been perfected for the New York caisson. It is somewhat

larger than the Brooklyn caisson. Owing to the greater depth to which it is necessary to go, and the greater pressure of air to be encountered, it will be lined with boiler plate inside, otherwise it is constructed of wood.

Other means besides the water shaft will be provided for the removal of the fine quicksand. Successful experiments to that effect have been made by Mr. Allen and Mr. Collingwood, during the summer. The depth of water varying from thirty-five to forty feet, at the site of that pier, the management of the caisson during its descent will be somewhat different, and a slight change in the frames and floor will be made.

To Mr. C. C. Martin, formerly chief engineer of Prospect Park, and now engineer of construction on the caisson, as well as to Col. Paine in superintending the building of the caisson and the excavation inside, I am under continued obligations. Also to Mr. Collingwood, in charge of the designing room, and to Messrs. Van der Bosch and Hildenbrand, draftsmen.

Respectfully submitted, W. A. ROEBLING, Chief Eng. N. Y. Bridge Co.

CONTRACTS.

We learn from Mr. Kingsley's report all of the work thus far which could well be done by contract has been let—after advertising for proposals—to the lowest responsible bidder.

The following are the principal contracts awarded.

The contract for making the caisson was awarded to Messrs. Webb & Bell, shipbuilders, of Green Point, L. I., and they have received for its construction one hundred thousand, two hundred and seventy-four dollars and fifty-one cents ($100,274·51). This contract was awarded on the 30th day of October, 1869, and the work was prosecuted with such energy, and with such fidelity to the plans furnished as entitle them to very great credit. A contract was entered into with Messrs. Mayhew & Co. for 1,800,000 feet, board measure, of yellow pine timber, at thirty-two dollars per thousand. This contract was promptly filled, and the timber was of superior quality.

On October 29, 1869, a contract was made with Messrs. Wilder, Son, & Co. for 1,800,000 feet, board measure, of yellow pine timber, at thirty-one dollars and fifty cents per thousand. This was delivered in time for the caisson, and was in all respects satisfactory.

On November 10th, 1869, a contract was made with Messrs. Hubbard & Whitaker, of Brooklyn, for the construction of the air, water, and supply shafts, shoes, shoe plates, etc., for the caisson, they being the lowest bidders.

On January 22, 1870, a contract was made with Messrs. Morris & Cummings, of New York, to furnish, and put in position complete, and ready for use, two of their machines for dredging, including the engines, hoisting gear, and buckets, for the sum of $9,000. These are in position and nearly ready for use.

On March 21, 1870, a contract was made with Messrs. Noon & Madden, of Kingston, N. Y., to furnish 5,000 cubic yards of limestone for the foundation of the Brooklyn tower of the bridge. The delivery of the stone has been promptly commenced, and the indications are that it will be supplied as fast as required for the work.

On April 11, 1870, a contract was entered into with Messrs. W. Taylor & Son, of Brooklyn, to furnish two engines for hoisting stone from the scows to the tower, for the sum of $2,250 each. The time for the delivery of these has not yet expired, but the work on them is well advanced.

NOTE.—The laying of the stone upon the top of the caisson was commenced the 15th of June, the day the above report was made public. One of the dredges spoken of in the report commenced working on Wednesday, the 22d. The caisson ceased rising with the tide on Saturday, the 18th, the tide being low, and a considerable weight of stone having been placed upon the structure. It is now thought that the weight will be added as fast, or faster than the tide increases, so that the caisson has probably risen for the last time.—[EDS.

ICE PITCHER CASE.---IN THE U. S. CIRCUIT COURT, EASTERN DISTICT OF PENNSYLVANIA.

Colburn, Executrix of James Stimpson, vs. George B. Garrett & Co.—This was an action brought by the administratrix of James Stimpson to restrain the defendants from manufacturing and selling ice pitchers.

The claims of the patent are:

1. *A pitcher for preserving ice water cool, combined with double walls inclosing between them air or equivalent non-conducting material, so arranged as not to impair the portability of the pitcher, and its capability of discharging its contents by pouring, nor its capacity for holding water.*

2. *In combination with a double-wall ice pitcher, a nose, lip, or spout, through which the water is discharged, and a movable cover across the discharge-way, which prevents access of air into the pitcher thereat except during the act of pouring.*

The defendants, Garrett & Co., manufactured and sold ice pitchers having both the features claimed, except that the cover over the spout was hinged so as to hang vertically. They denied the validity of the patent, and relied mainly upon old teapots and coffeepots manufactured by Isaac S. Williams, of Philadelphia, forty years ago, having, as it was alleged, double walls; also upon an old teapot which has been in the family of Mrs. Fine, in Philadelphia, for many years, having double walls.

The court decided that the teapots referred to as the "Fine" teapot and the "Williams" teapot are not the same invention as the ice pitcher of James Stimpson, and that the first and second claims of the plaintiff's reissued patent are valid, and that the defendants have infringed the same, and that a decree be entered for plaintiff with costs, and that the case be referred to John Cadwalader, Jr., Esq., as master.

Harding for plaintiff; Diedrick for defendant.

NEW BOOKS AND PUBLICATIONS.

LIFE AT HOME; or the Family and its Members. Including Husbands and Wives, Parents, Children, Brothers, Sisters, Employers and Employed, the Altar in the House, etc. By Rev. William Aikman, D.D. 1 vol., 12mo. Nearly 300 pp., tinted paper, muslin, beveled boards. Price, plain, $1·50; extra gilt, $2·00. S. R. Wells, publisher, 389 Broadway, New York.

This is a very excellent and timely book, one that should be read by parents and children alike. The counsel is wholesome—the criticisms none too severe.

LIPPINCOTT'S MAGAZINE, for July,

contains an article from the pen of Justin McCarthy on "The Petticoat in the Politics of England," which contains much to instruct and something to amuse. A paper on "The Hypothesis of Evolution, Physical and Metaphysical," by Edward D. Cope, states arguments and facts in support of this doctrine, and at the same time suggests some "consequent necessary modification of our metaphysical and theological views" resulting from its acceptance. "A Week among the Mormons" adds but little to our knowledge of Young and his followers, but will interest readers who are not tired of the subject. "Negro Superstitions," by Thaddeus Norris, is a very readable and entertaining article. The usual amount of lighter reading is supplied, and is of good quality.

THE ATLANTIC MONTHLY, for July,

opens with a poem by Longfellow, "The Alarm Bell of Atri," which will be read with delight by all lovers of poetry. "Equal, yet Divine," by Burt G. Wilder, touches upon that absorbing question of the time the future status of woman in society. "Criminal Law at Home and Abroad," by Francis Wharton, and "The Shipping of the United States," together with Mr. Burt's contribution, are the solid dishes of the feast. The usual side dishes and dessert are added.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

1,429.—AUTOMATIC BARREL-FILLING APPARATUS.—S. C. Catlin, Cleveland, Ohio. May 18, 1870.

1,454.—ROLLING METALLIC RODS OR WIRE.—J. P. Blake, Medway, Mass. May 19, 1870.

1,487.—MACHINERY FOR GRINDING HAND SAWS.—W. F. Semple, Mount Vernon, Ohio. May 23, 1870.

1,490.—TREATING LEATHER.—Ed. Fitzhenry, Boston, Mass. May 23, 1870.

1,500.—EARTH CLOSETS, ETC.—C. A. Wakefield, Pittsfield, Mass. May 24, 1870.

1,508.—MAKING METAL COP TUBES.—James Eaton, Boston, Mass. May 24, 1870.

1,508.—CONNECTIONS FOR FIRE ENGINE HOSES, ETC.—Loftus Perkins, London, England, and M. Gibs, Washington, D. C. May 24, 1870.

1,512.—WASHING MACHINE.—J. T. Owen Philadelphia, Pa. May 25, 1870.

MACHINERY FOR FORMING BATS OF WOOL FOR FELTING PURPOSES.—L. Robinson, Matteawan, N. Y. May 25, 1870.

Business and Personal.

The Charge for Insertion under this heads One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

J. H. P., of Ark., asks, will a 100-pound weight drive light machinery, sewing machines, etc. We answer that a 100-lb weight falling through a sufficient space in a given time would drive the Great Eastern, were the power thus developed applied to the propulsion of that monster. This correspondent is evidently laboring under a very common misapprehension; the confounding of statical pressure with mechanical power. Statical pressure is not mechanical power. It never did and never will do work in the sense in which the term work is used in mechanics. It takes on an average about one tenth of a horse power to drive a sewing machine. To yield this power a 100-pound weight would need to fall through a space of three and three tenths feet in one minute of time, and continue moving at that rate.

J. H. P., of N. Y.—This correspondent writes in regard to the use of hellebore to kill currant worms. He says the white hellebore is as good as the black. This weed is also known as poke, or itch weed. It is not so expensive as the other. He makes a strong decoction of the leaves and stems, pours off the liquor, and applies it cold, with a watering pot. He says that a single application made at the night time, that is, when the eggs are all hatched, will be effectual in destroying the worms. He asks for something to kill maggots which destroy onions. Can any of ou correspondents inform him?

W. & B., of Tenn.—Petroleum products, such as gasoline, are tested for their specific gravity by an instrument called an hydrometer. The lighter the fluid the deeper this instrument will sink into it. Gasoline or benzine spoken of as being 85° allows the instrument to sink to that number marked upon the stem.

M. H. S., of N. Y.—We cannot at this distance say what makes the bearings you describe heat; there are many things that might do it. The belts may be too tight, the bearing surfaces too small for the weight they support, or the lubricator used may be of a kind which evaporates as soon as the bearings become warm. We think it likely that the bearing surfaces are too small.

J. K., of Pa.—We should regard a scale of three eighths of an inch in thickness as dangerous in any steam boiler. To drive any engine at greater speed while performing an increased amount of work will require more steam, and consequently more fuel. Your question cannot be answered more definitely without more complete data.

S. K., of Mo.—Your solution of the 2d mechanical problem given out some weeks since is correct; it was also given by another correspondent. See article entitled "New Mechanical Movements" in last issue.

L. R. P., of N. H.—There are various methods of making solid emery wheels, mostly patented, and therefore not available to you except by purchase. We cannot describe any of them in this column.

J. G. S., of Vt.—What is meant by the pitch of saw teeth is the inclination of the face of the tooth up which the shaving ascends, and not the intervals from tooth to tooth as in wheels.

N. F. E., of Vt., wants a size that will cause bronze to adhere to paper, linen, etc., and which will not stain or color. Do any of our correspondents know what will do the business?

J. W., of L. I.—The plan of compressing air into receptacles to be afterwards used as motive power is old. It has many elements of impracticability which we cannot specify here.

T. A., of Mass.—Medals when dipped into the "bronze dips" described on page 265, are to be subsequently washed in water, and brushed. That is the whole of the process.

C. G., of Ohio.—Carbolic acid in weak solution is recommended as a preservative of awnings from mildew. Chloride of zinc has also been used.

A. A. E., of Mich.—A cement called marine glue is kept for sale pretty generally in drug stores, which unites wood and resists moisture.

G. E. R., of Mass., wants to know what will exterminate black ants from beams and flooring which they have bored into.

D. L. B., of Pa.—We published a rule for the computation of the sizes of cone pulleys on page 157, last volume.

W. W. W., of Ohio.—The expression "groin arch" is a misnomer; "groined arch" would be a correct term.

S. M. C., of Ohio.—The true length of the old measure called a digit is three fourths of an inch.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MACHINE FOR BORING POSTS AND POINTING RAILS.—Rudolph Martin and Matthew Harner, Taneytown, Maryland.—This invention has for its object to bore fence posts in order to the making of mortises therein, and to sharpen fence rails in order to the insertion of their pointed ends in such mortises.

STREET AND STATION INDICATOR FOR RAILWAY CARS.—Edward L. Dean Newburgh, Ohio.—This invention has for its object to cause the index finger of a dial plate affixed to the inside of a street car to travel over its surface and point out the names of streets and stations as they are successively reached.

SADDLE.—George Horter, New Orleans, La.—The object had in view in making this invention was the production of a very cheap, and, at the same time, a very durable saddle, mainly for use in districts like the Southern and South-western parts of the United States where horse-back riding is the chief means of locomotion, and where most of the inhabitants are very poor.

WATER WHEEL ATTACHMENT.—W. A. Cobb, Orange, Mass.—This invention has for its object to prevent water wheels from being stopped by the "back water" of floods. To this end the invention consists in providing a casing extending from the floor of the flume on which the wheel rests to the bed of the river, which casing receives the water flowing from the wheels through the floor of the flume, and discharges it through one of two pipes, a short one for ordinary use and a very long one for flood seasons, which discharges at a point not affected by the high water of the stream, and consequently renders the casing and flume impervious to the surrounding water, the gate to the short pipe being, in the mean time closed.

HONEY-BEE PALACE.—Nathaniel F. White, Mount Pleasant, Iowa.—This invention relates to a new and useful improvement in a house or palace for honey bees, in which their hives are placed and where they are protected from moths and from the weather.