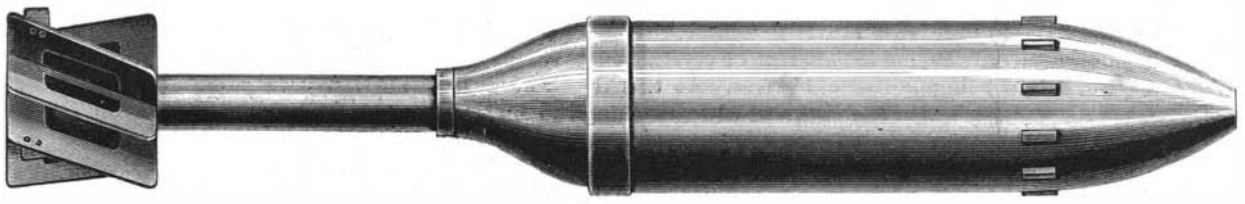
TRIAL OF THE PNEUMATIC CRUISER VESUVIUS.

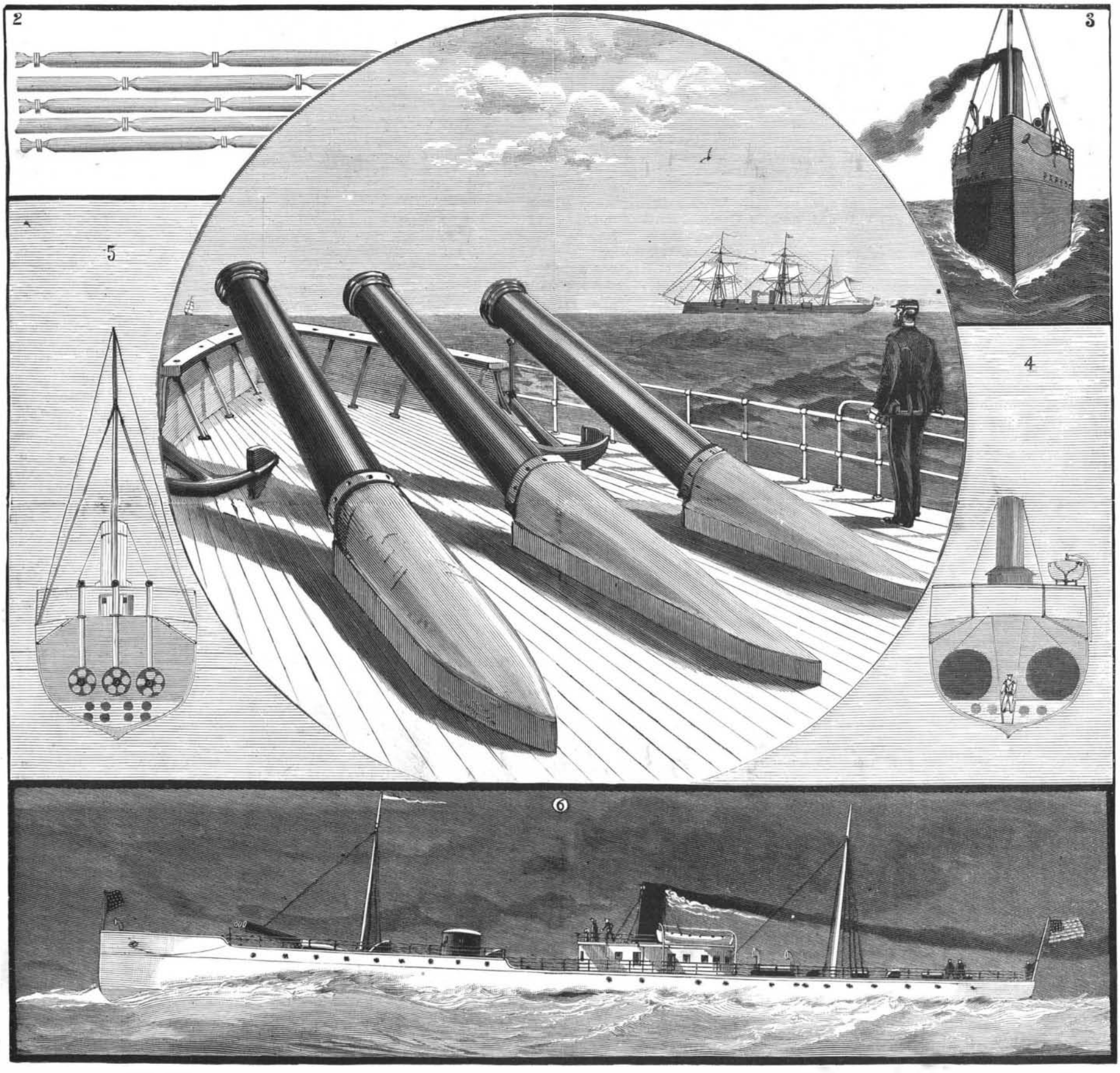
The pneumatic dynamite cruiser Vesuvius has been awarded a second and more exhaustive trial to determine her efficiency in projecting aerial torpedoes by compressed air. The torpedoes are discharged from the so-called Zalinski gun. These weapons represent the ideas of some years ago. In practice from a stationary land platform they have shown the highest degree of efficiency. The destruction of the schooner Silliman, described and illustrated in our issue of October 1, 1887, showed the terrible powers of the weapon as a torpedo thrower.

The Vesuvius was built at Cramps' ship yards and was launched April 28, 1888. The object in building her was to secure high speed and powers of maneuvering. In action she is to run up quickly within a mile of the enemy, discharge her torpedoes, annihilating the target in as few shots as possible, and then to retreat. Her fighting is done under peculiar circumstances. She must be bow on to her target. Thus she offers a small mark. She can do no broadside fighting whatever.

The first trial of the ship as a torpedo thrower took place nearly a year ago, and did not impress our naval authorities favorably. The present trials are designed to determine definitely the value of the guns and torpedoes, and the accuracy which will be attained with them in stationary practice and when the cruiser itself is moving. If the vessel proves a failure in her proper capacity she will be transformed into a dispatch boat, torpedo boat, or other type. The general plan of the cruiser provides a very fast ship with three guns arranged at an elevation. The guns are for most of their length inclosed within the hull; but their muzzles project, side by side, from the forward deck, as shown in one of our engravings. The ship is of 725 tons displacement, 252 feet long and 26½ feet wide. She draws 9 feet of water and is practically unarmored. Some protection is given by her coal bunkers and deflective deck. Her engines, of 4,000 horse power, are designed to drive her at the speed of at least 20 knots. There is no question that in view of recent achievements this speed is too low. One shell entering her hull would probably annihilate her by exploding the tons of guncotton in her torpedoes. The guns are set at an angle of elevation of 18°; they are 15 inches in diameter, 54 feet long, and are made of thin cast iron. Under each gun, and toward its breech, is placed what is known as the revolver. This is a cylindrical structure, resembling an enlarged revolving cartridge chamber of a pistol, and arranged to carry five projectiles. To load the gun, the rearmost section of the gun, which is pivoted at the back, is dropped to a horizontal position, in line with one of the chambers of the revolver. See Fig. 2. The shell is introduced and the forward end of the gun section is again drawn up in line with the rest of the barrel by means of a vertical pneumatic ram. Our cuts show the general disposition of all of these parts. It will be seen that when the revolving cartridge chamber is charged with five shells, after one has been loaded and discharged, a simple turn of the chamber brings another shell into loading position, so that the five can be rapidly introduced and fired.



THE RAPIEFF PROJECTILE FOR PNEUMATIC GUNS.



1. The central cut shows the bow of vessel and the mouths of the pneumatic guns. 2. The storage air cylinders. 3. Bow view of the vessel. 4. Cross section, showing position of boilers. 5. Section showing the pneumatic guns. 6. The Vesuvius running at full speed.

THE UNITED STATES TORPEDO CRUISER VESUVIUS.

The ship is steered by steam and has twin propellers. Thus she has high maneuvering ability, and it will be seen that this is very essential. It is to be regretted that water jets at bow and stern have not been applied to increase her turning powers. The range of the projectiles, as the guns have a fixed elevation in still water, is determined entirely by the amount of air admitted

for the discharge. The range being thus regulated, the direction has to be determined by changing the position of the ship. The ship, in other words, represents a gun carriage, and the pointing of the gun is effected by making the ship point in the desired direction. The necessity for high capacity of maneuvering is obvious.

Accuracy in firing will be interfered with by several things. The pitching of the ship will alter the trajectory by giving different elevations of the guns. The rolling of the ship will also affect the elevation of the discharge, and at the same time will give a right hand or left hand deflection according to the direction of the roll.

The compressed air supply for the guns and pneumatic machinery is supplied by two Norwalk compressors. These force the air into tubular reservoirs, each 16 inches in diameter and 13-16 of an inch thick, made of wrought iron; some of the tubes are 20 feet and others are 25 feet in length. It was proposed to store the air at 2,000 lb. pressure per square inch, and to maintain the firing reservoir at a pressure of 1,000 lb. per square inch.

The three guns were built four or five years ago and do not, of course, represent the most modern type. In these trials the most recent projectiles of the Rapieff construction are employed, and are considered an important advance on the old shell. For much of the work dummy shells made of iron are used to save expense.

We illustrate the Rapieff shell as it is designed to be definitely used in warfare. For the 15-inch gun, which is the size in use on the Vesuvius, the entire shell is 10 feet long, including tail and wings.

The extreme length of the head is 91 inches. The front of the head is of cast bronze, the middle cylinder is of wrought iron and the base is of cast bronze. The tail is a 6-inch bronze tube, 34½ inches long, of which 29 inches project from the rear of the head. The head is filled with 500 pounds of wet guncotton. This is a peculiarly safe form of explosive, far safer than dynamite or explosive gelatine, the explosive originally proposed, as it is almost impossible to explode it except under definite conditions.

These conditions are supplied in practice by what is known as a priming charge of dry guncotton. This is inserted into a cylindrical chamber in the axis of the explosive. In the ordinary type of shell, the primer comes immediately in front of this dry guncotton. The primer works mechanically by three methods. Within a little chamber a ball is held at the rear of the chamber by a spring. If the projectile strikes the water or soft earth, its speed will be retarded and the inertia of the ball carries it forward, where it strikes a firing pin and explodes some fulminate. When earth or water is struck, it is desirable to have the torpedo penetrate before exploding; hence the flash from the fulminate does not at once reach the guncotton, but sets on fire some slow-burning composition. When this is all burnt up, it effects the explosion of the dry guncotton, which, acting as a priming charge, causes the whole mass to detonate.

The condition of impact against the sides of an ironclad is next provided for. This effects a similar type of inertia discharge except that the direct impact against the head of the shell brings about an instant ignition of the dry guncotton so as to produce the detonation without delay. Finally side impact against the forward portions of the shell is provided for by surrounding it by eight firing pins, any one of which when forced inward produces instant ignition of the charge. Until the piece is fired these pins cannot effect the discharge, a metal slide or gate intervening between their ends and the fulminate. This slide, on the discharge of the piece, is sprung out of its position, so as to leave the crown of firing pins free to act.

On board the ship it is proposed to keep the shells charged with wet guncotton. The primers and priming charge are only introduced shortly before firing.

The shell has 12 helical wings at the extremity of its tail piece to give it direction and spin. In the full caliber projectiles, every second wing carries a little block of fiber to center the rear and to prevent the wings from touching the walls of the gun. A 1½ inch oak shield or disk is attached to the rear to protect the wings. This drops off as the projectile leaves the gun. At the base of the head is the gas check, and a number of small blocks of fiber encircle the head to hold it in axial position. Shells of less than the proper diameter known as sub-caliber shells are also used. These are centered at the rear by a disk-shaped gas check.

The front is centered by four oak sabots or shoes. As the piece emerges from the gun these are displaced by the blast of air, so that in all cases the projectile accomplishes its flight without any impediments. The trial so far has been exceedingly satisfactory, and it is believed that certainly an important advance in the art of war has at last been evolved.

The first of the present series of trials were made with the vessel fast to the dock. Exhaustive trials of accuracy when in motion will follow. The critical test, however, is the hitting of a moving target. At Port Royal, S. C., the place of the trial, the best possible facilities for all this work are present.

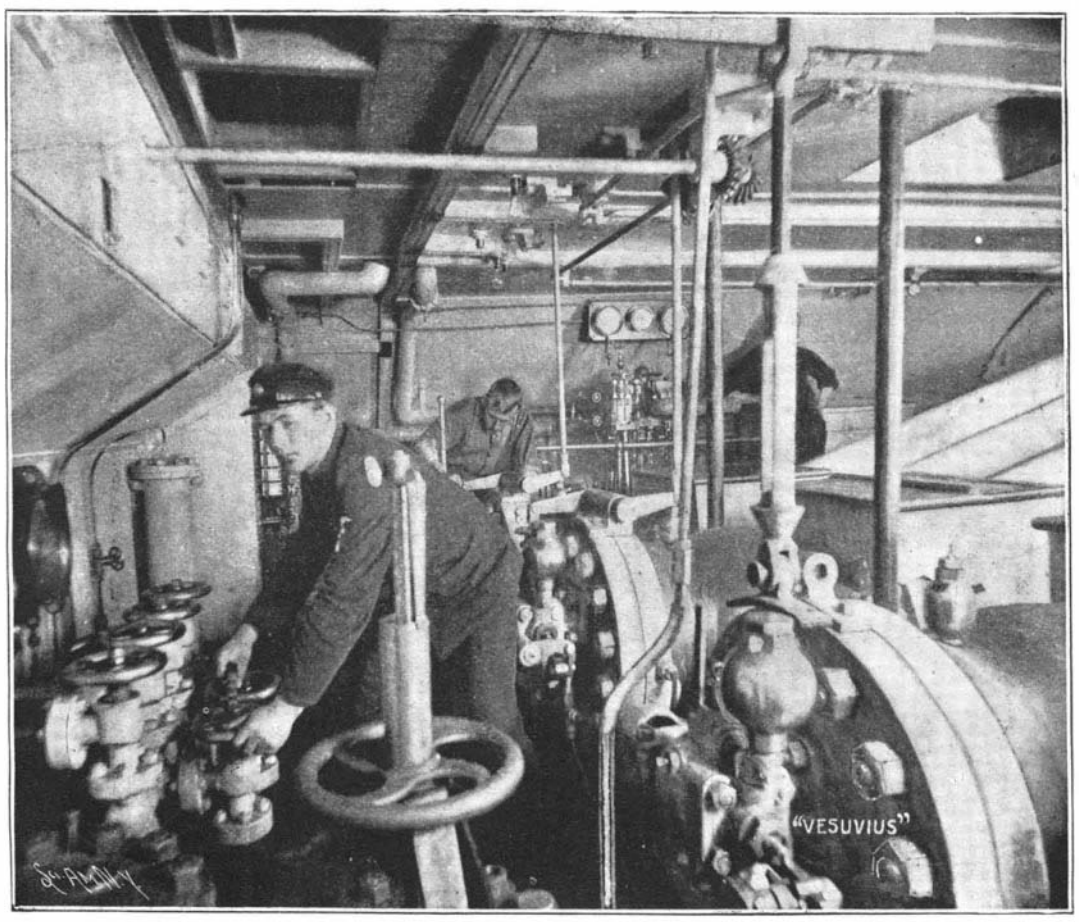


Fig. 1.—THE FIRING BREECHES—TORPEDO BOAT VESUVIUS.

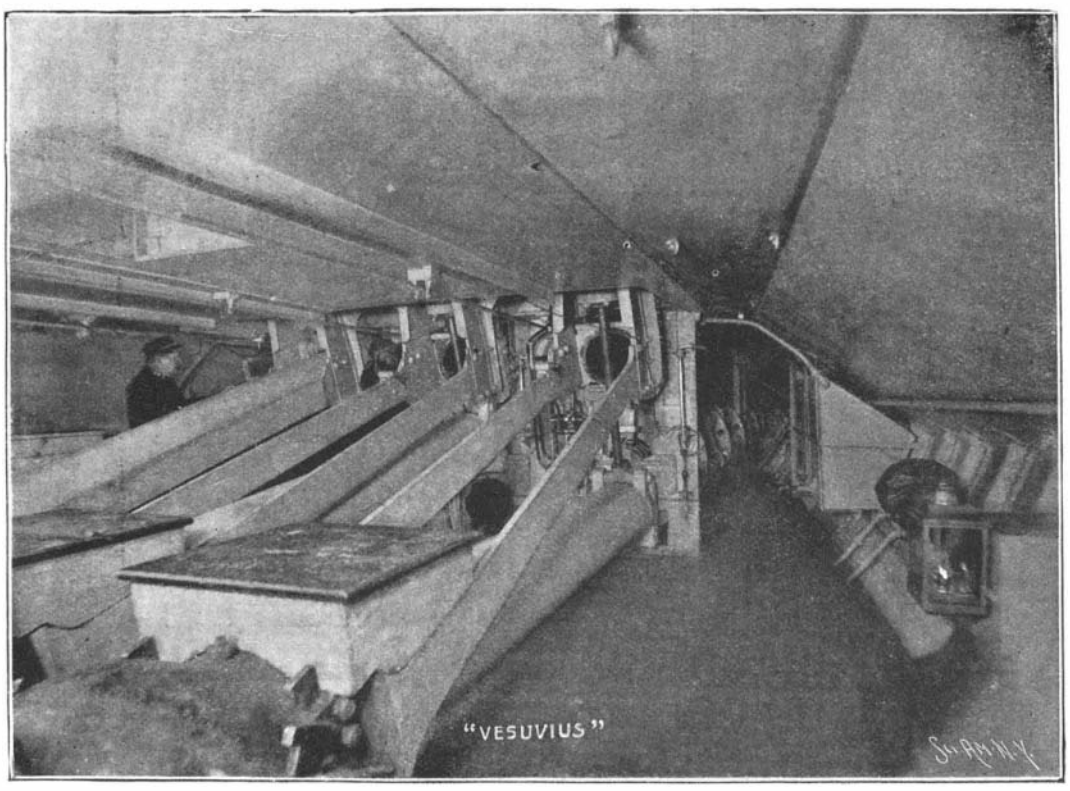


Fig. 2.—THE LOADING TUBES—TORPEDO BOAT VESUVIUS.

Nine Hours' Work for Ten Hours' Pay.

"Have you ever realized," said a business man recently, "what nine hours' work for ten hours' pay means? Supposing a factory employ fifty hands at two dollars a day, which is twenty dollars an hour for ten hours' work. Therefore nine hours' work means giving each man twenty cents a day, the fifty men ten dollars a day, or three thousand dollars for the three hundred working days in a year. But that is not all. In order to turn out the same amount of output, the manufacturer must make up this one hour by hiring one new man for every nine men, or five new men for the fifty men. The five new men, at two dollars a day, cost ten dollars a day, or another three thousand dollars for the three hundred working days, a total of six thousand dollars, or twelve per cent extra cost on an output of fifty thousand dollars. If the manufacturer does not make up the lost time by hiring the new men his pay-roll has, nevertheless, increased three thousand dollars a year, while his output will have decreased ten per cent, because of the one hour in every ten granted the men. It means again additional space or additional machinery for the five new men, which represents another three per cent at least. Thus you see that the demand for ten hours' pay for nine hours' work, which looks so innocent on its face, amounts to fifteen per cent extra expense on the cost of the goods, when the average profit is only about six per cent. Therefore, except this is made a universal rule everywhere, any manufacturer granting it will simply be wiped out by the competition, having this fifteen per cent disadvantage."—*Cincinnati Commercial Gazette.*

Oil Fuel at the Fair.

Oil will be the fuel used in the large steam plants of the Columbian Exposition, and it will be furnished by the Standard Oil Company at the price of 72½ cents per barrel of 42 gallons delivered on the grounds, so says the *Railway Master Mechanic.* The Standard Oil Company guarantees to furnish all the oil that may be required at this figure, and will deliver it through an extension of one of its pipe lines which now enters South Chicago. The Exposition Company will provide sufficient storage capacity by constructing twelve tanks, each 8 feet in diameter and 25 feet long and holding 9,400 gallons, or a total of 112,800 gallons. The tanks will be placed underground in a suitable vault. From these tanks the oil will be pumped into a stand-pipe, 30 inches in diameter and 300 feet high, by two Snow duplex pumps. This pipe is connected with the 5 inch wrought iron main leading to the boilers.

Mercurial Ointment.

A recommendation by H. Borntraeger, according to which it is possible to make an ointment containing 98 per cent metallic mercury, consists in triturating the mercury with oleate of mercury; the ointment of this strength is suitable for preparing the officinal ointment by diluting with lard. It is also considered feasible to change the liquid character of mercury to that of a solid with the aid of a little oleate of mercury and thus avoid the shipment of a troublesome liquid. After transportation ether will extract the oleate, leaving the mercury again in the liquid state.—*Pharm. Post, 1892, 1245; American Journal of Pharmacy.*

Equity in Patent Cases.

BY J. C. CLAYTON.

Whether or not the United States courts, sitting in equity in patent cases, will venture to show a larger liberality in prescribing conditions for the granting of injunctions is a grave question. The statutory patent law rests upon the constitutional provision authorizing the granting of privileges to authors and inventors for the purpose of promoting the progress of science and the useful arts; and the Constitution itself was made to promote the general welfare of the people.

When, therefore, the law is so enforced as to maintain a monopoly that is destructive of the promotion of science or art, or that is against the general welfare, there is a violation of the constitutional and fundamental prerequisites. Though the patentee receives an exclusive grant, he remains subject to those constitutional qualifications; he cannot override them, nor can he overthrow the maxim, *Sic utere, non abutere.* No court of equity should sustain a patentee in the non-use or the misuse of his invention. His patent is a contract between himself and the government representing the people, and is the result of a public policy primarily created for the welfare of the people.

Few inventors have ever long anticipated others in the same field; although, for his priority, the inventor gets a patent, yet, as a rule, in a few days or a few years others would have reached the same result. It is therefore against natural justice that a right so given by the people should be used for extortion or oppression, or in any way against the general welfare. In a mere race of diligence Jones may secure a patent for a lamp over Smith, who may have been too late by one day, and Smith may have other cognate valuable inventions useless without the privilege of the Jones patent. Both may be great and successful manufacturers of lamps, and through their healthful competition the people may be greatly benefited. But, if Jones be upheld in his determination that Smith shall not on any terms use the Jones patent, then an "odious monopoly" is created, fair competition is destroyed, Smith is ruined, and the people are completely at the mercy of Jones, the monopolist.

In such a case it would seem that a court of equity should be able to refuse its peremptory injunction if Smith should secure a reasonable license fee to Jones. In other words, in the high court of conscience (the "court of equity") the familiar and highest principles of equity should govern; and the wrong of a harsh injunction should be balanced against the wrong of an infringement, while the court, holding a just balance between the actual parties, should remember that the public is, in no narrow sense, always an interested party in every suit upon a patent. I know that, *strictissimi juris*, an exclusive right is granted to the patentee, and that in a suit, on the law side of the court, this legal right, no matter how harsh it may be, must be enforced. But if the patentee elect to enter the court of conscience rather than the court of law, he must abide by its more liberal and merciful conclusions. Generally, "equity follows the law," but not to enforce the unconscionable or the cruel, nor to uphold unclean or unmerciful hands. Generally, too, when a patent is finally sustained on the merits, an injunction follows, which practically leaves the respondent and his business to be executed by the complainant without mercy or benefit of clergy! My view is, that there must be a new departure in this respect, either by judicial construction or by statute. And although I took no part in the incandescent lamp case, I was not without a hope that the court might find occasion to take the new departure above suggested.

Indeed, to a notable extent, it did depart from the harsher practice of the past, for it granted leave to apply for a dissolution of the injunction in case the complainant refused to supply its lamps to respondent's customers upon reasonable terms. To this extent I think the court made an advance in the line of mercy and liberality which has been herein suggested; perhaps in the next great patent case, where the respondent has his own additional patents and has invested millions in his plant, the court will go the length I have indicated and permit the respondent to continue his manufacture upon reasonable terms fixed by the court, with due regard to the interests of the parties and of the people.

Unless courts of equity more nearly approach such liberality, as they may by force of construction and constitutional law, some arbitrary statute inimical to patents will soon be enacted. Even now several harsh patent bills are pending in Congress. One authorizes the Secretary of the Interior and the Commissioner of Patents to fix the maximum price for the use of a patent, and provides that in case of a higher price being demanded the patent shall be forfeited to the public; another limits the term of a patent to seven years. In the wise and very liberal administration of equity all interested in patents will find their truest protection.—*N. Y. Times.*

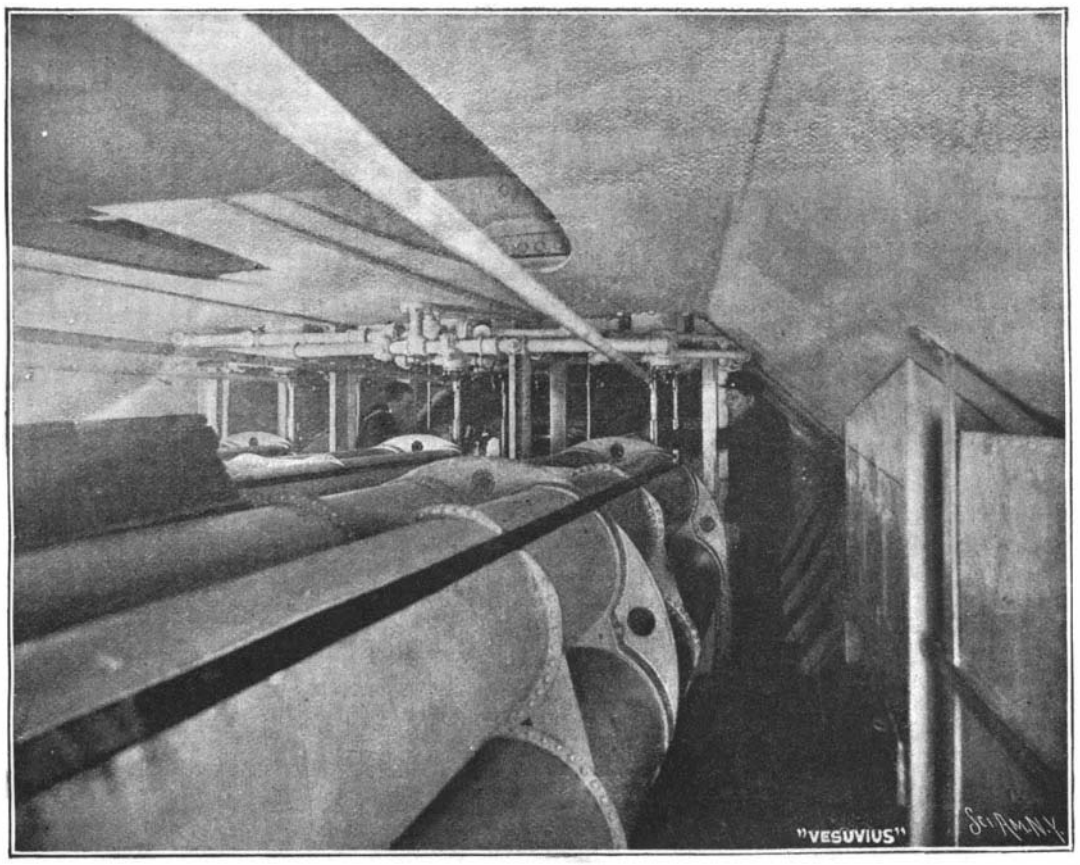


Fig. 3.—THE REVOLVING CARTRIDGE CHAMBERS—TORPEDO BOAT VESUVIUS.

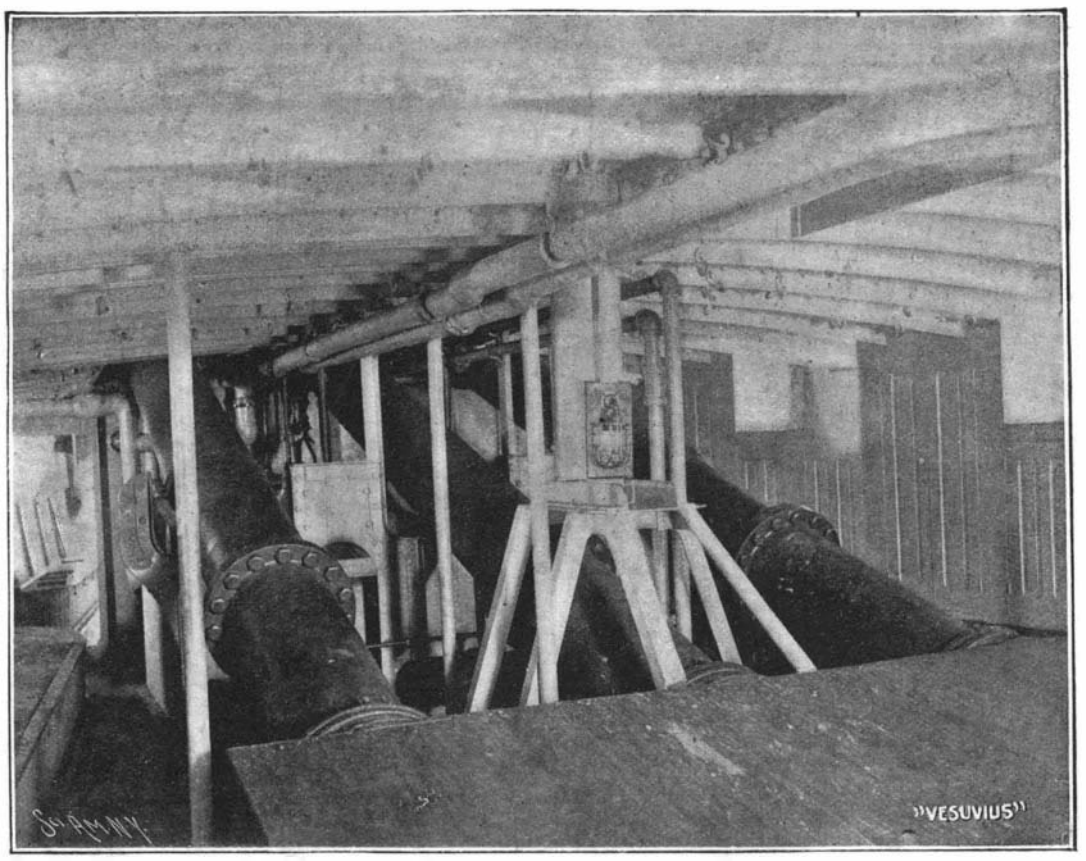


Fig. 4.—THE PNEUMATIC GUNS AS THEY APPEAR BETWEEN DECKS.

Spontaneous Combustion of Coal.

With respect to the ventilation of a cargo of coal, with the idea of removing inflammable gases, Professor Clowes, of Nottingham, has pointed out that this might itself be a source of danger. Four colliers were loaded with coal from the same seam, and by means of the same tips. Three were ventilated, and proceeded on their journey to Aden. None of these reached the port, being all lost by the spontaneous firing of their cargoes. The fourth was not ventilated, and it reached Bombay in safety. There was little doubt that the air inclosed in the cargo was insufficient to give rise to dangerous heating, and that the introduction of additional air by ventilation enabled the heating to occur by supplying the requisite air. Coal which had heated in the air and begun to cool again was safe from risk of further heating; hence, storing coal in the air for a sufficient length of time before loading was a precaution which would be calculated to insure the safety of the cargo.

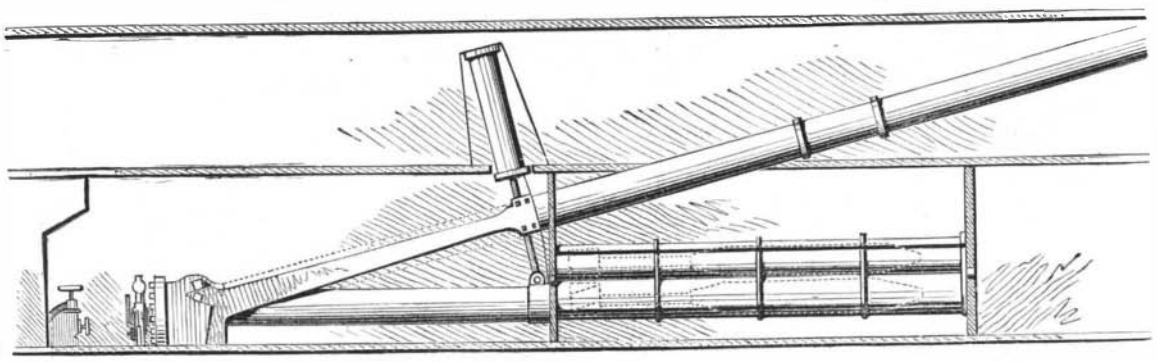
The following practical conclusions were submitted as deducible from the facts presented: 1. The danger of spontaneous firing of coal in large lumps is very slight; it is much greater with small coal, and greater still with dust. The increase of danger is due to the larger extent of surface exposed to the air in proportion to the mass of the coal. 2. Air-dried coal which contains more than 3 per cent of moisture is dangerous; if it contain less, the danger diminishes, as the amount of moisture is less. The moisture present in the coal is a measure of its absorptive power for air, and the most absorptive coal is the most dangerous. 3. The danger is somewhat increased by the presence of pyrites, in large quantity, not because this heats the coal to any appreciable extent, but because, when moistened, it swells—breaking up the coal, and exposing a larger surface to the air. 4. Newly won coal should be shielded from the air as much as possible, to prevent the chance of rapid heating, and for the same reason it is best not to stack it in large heaps, since these retain the heat. Ventilation of the coal often adds greatly to the risk of spontaneous firing. 5. All external sources of heat, such as steam pipes, boilers, and hot flues in the neighborhood of the coal, add very greatly to the risk of firing. Spontaneous heating becomes vastly more rapid when it is thus assisted by outside sources of heat.

Pneumatic Tube Service.

The Postmaster-General on behalf of the United States has executed an agreement with the Pneumatic Transit Company, of New Jersey, by which the latter contracts to lay, at its own expense, a line of two parallel iron pneumatic tubes of an inside diameter of 6⅛ inches, for the transit of mails between the main post office building and the sub-post office on Chestnut Street, below Fourth Street, in Philadelphia. The company agrees to bear the entire cost of maintaining and operating them for one year, and to remove them when required to do so by the Postmaster-General. It will turn the tubes over to the Post Office Department for one year after completion for such practical tests as the postmaster at Philadelphia or the Postmaster-General may direct, without cost to the United States. The company will lease or sell to the United States.

Model of the Caravel of Columbus.

The *Marine Review* says: The State Department has been informed that there has just been received at New York a large model of the caravel of Columbus, the Santa Maria, which was constructed on the island of Santo Domingo, under the personal direction and supervision of Senor Don Andres Gomozy Pintado, the secretary of the Spanish commission for the Madrid exposition. It was designed with great care from original drawings made by that gentleman, who is an enthusiast in such matters, and has paid much attention to ancient naval architecture, and is considered an expert, having made many studies from all the ancient engravings obtainable with this special purpose in view. This model is something more than a toy, being 18 feet in length, 6½ feet beam, having a depth at the stern of 8 feet, and is fully rigged. It was first used in the festivities with which the discovery of America was celebrated in the city of San Domingo, in October last, being carried through the streets of that town in the grand procession that took place, manned by a bevy of little girls as a crew. It was then placed in the river Ozama and sailed to the point of embarkation by the Clyde line for the United States. This reduced replica of the Columbus caravel was constructed at the suggestion of Mr. Frederic A. Ober, the Exposition commissioner to the West Indies, and will form part of the Columbian exhibit of the State Department at Jackson Park.



THE VESUVIUS—DIAGRAM SHOWING GENERAL ARRANGEMENT OF THE GUN-LOADING MECHANISM.

A FEAT IN HOUSE MOVING.

The ferry house located at the Brooklyn terminus of the 39th Street ferry between the Battery in New York and South Brooklyn, is a brick structure 52×110 feet. This building was located at the foot of 39th Street. The Brooklyn City Railroad Company required increased facilities in that part of the city, and in consequence of this the ferry house was removed from its original site 140 feet westward and 25 northward, and when the job is completed the building will stand 17 inches lower than it stood on the old site. This work was done in about one month, without injury to the walls, and at much less expense than would have been involved in tearing down and rebuilding.

The building was placed on a rigid framework and its walls were shored and braced by tie rods and cross timbers, as shown in Fig. 2, and it was moved on ways consisting of a framework of heavy timbers provided with diagonal guides which caused the building to move sidewise as well as endwise, the frame upon which the building rested being provided with shoes sliding upon the diagonal guides, as shown in Fig. 4. The abutments against which the moving screws rested were heavy timbers secured to the ways by means of chains, as illustrated in Fig. 3. After the screws which abut upon the timbers had been run out their full length, they were returned to their original positions and the timbers moved forward and again made fast in the manner indicated, when the operation was repeated.

This job was done by B. C. Miller & Son, of Brooklyn, N. Y., who moved the Brighton Beach Hotel bodily in 1888, after the damaging encroachment of the sea on the beach. The building was 465 feet long and 150 feet deep, three stories high and weighed 5,000 tons. It was moved 239 feet back of its original position upon 112 platform cars by means of six locomotives.

A Remarkable Bicycling Tour.

W. L. Sachtleben, of Alton, Ill., and Thomas W. Allen, of Ferguson, Mo., have arrived in San Francisco from Vancouver, B. C., after making a tour of the world on bicycles. On June 30, 1890, they finished their course of study at Washington University, St. Louis, and then started. They visited Washington, D. C., and on June 23 sailed from New York, landing in Liverpool on July 4. Their bicycles purchased and a tour made of the British Isle, thence to France, their route took them through Rouen, Paris, Chartres, Poitiers, Bordeaux and Marseilles. The Riviera route along the shores of the Mediterranean was followed, and Genoa, Rome and Milan, in Italy, were visited. At Athens the first long halt was made. To Constantinople was the next jaunt, and their preparations for the invasion of Asia were begun.

"Our first exploit, of which we are a little proud," says Sachtleben, "was the scaling of Mt. Ararat. We are the first Americans that reached the top, and the natives could hardly believe we had succeeded. We started on July 2 and reached the summit July 4. There we celebrated the American holiday by waving the American flag and firing off shots from our revolvers.

"On our return the Governor of Bayazid gave a dinner in our honor.

"Through Turkey in Asia we rode, and through Persia, visiting Teheran on our way.

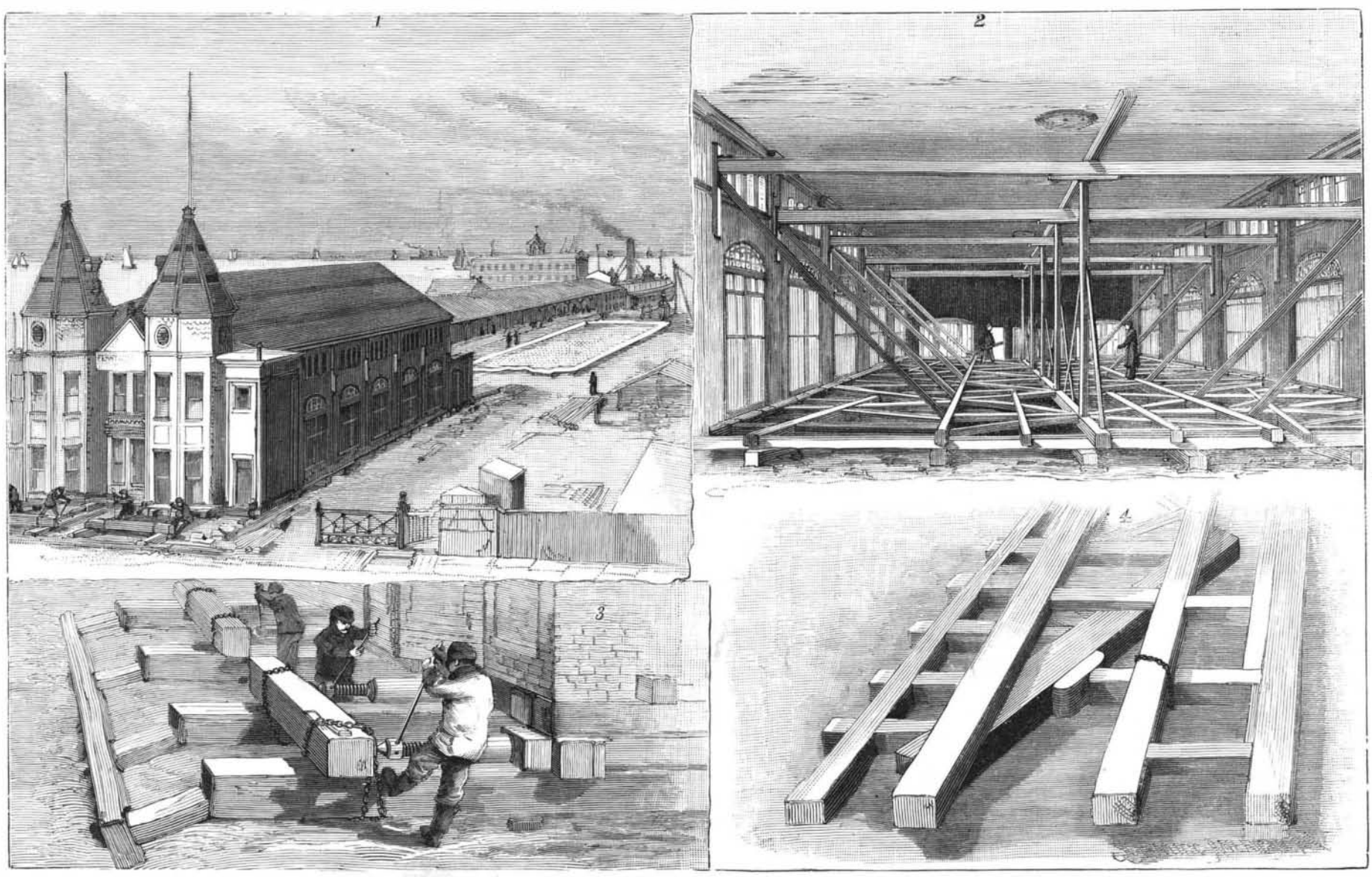
"Our journeying was along camel paths, there being no other roads. At Tashkend, the capital of Turkestan, we remained from November, 1891, to May 7, 1892, and spent a good deal of the time in studying the Russian language. We often had occasion to notice the eager attitude of Russian sentiment regarding the advance upon British Afghanistan. The Russians are very friendly to the Americans, and on this account we received many courtesies. Our last stopping place in Russian territory was at Vernoe, and here the people tried to dissuade us from making the attempt to go to China. Relying on a special passport which had been given us by a Chinese minister in London, we determined on trying to get through.

"After leaving Kulja the route was taken by way of the Urmpse to the border of the Gobi desert, at Hami, and there we were agreeably surprised at the character of the roads. In some places the desert had a hard bed, and this enabled the machines to make moderately good progress during the twelve days it took to cross."

Pushing on to Suchew, the western end of the Great Wall was reached, leading on to Lan-Choo. Then they proceeded to Singan, Ping-Yang, Tai-Yuan, and Poting-Fu, arriving at the latter place on the 20th of October, whence they rode to Pekin. The fact that they had already traversed China without personal inconvenience astonished all the diplomatic representatives there.

After resting there they went to Shanghai, where the machines were repaired. Afterward they intended to go to Japan, but received letters asking them to return home, so they left at once, touching at Nagasaki, Kobe and Yokohama, whence they sailed December 9 last. Sachtleben stated that while the trip in many respects had been a hard one, they enjoyed it greatly. They met with no annoyances from the natives in any of the countries passed through, excepting China.

To make ice by artificial means requires one ton of coal to produce from five to ten tons of ice.



MOVING THE BRICK FERRY HOUSE OF THE 39TH STREET BROOKLYN FERRY.