NEW YORK HARBOR IMPROVEMENT MODELS AT THE COLUMBIAN EXPOSITION.

Visitors entering the United States government building from the western entrance facing the lagoon, will find the exhibit of the Corps of Engineers of the War Department, consisting of representations of the work done at the mouth of the Mississippi River; of the harbor at Key West, Fla.; Iron Pier at Lewes, Del.; Delaware Breakwater, and models showing the improvement of New York Harbor.

These latter delineate as a whole an engineering achievement of the first rank, and are as perfect specimens of technical work as can be found.

These models have been constructed under supervision of Lieut.-Col. George L. Gillespie, who is in charge of the work they represent, and to whom and his assistants, Mr. J. Paul Mayer, Mr. Harrington, and others, we are indebted for the opportunity of inspection and also for information concerning the same.

The approach to New York City at the entrance of New York Harbor, near Sandy Hook, is controlled by a narrow neck of shifting sand that is continually yielding its substance to the waves of the Atlantic that break upon its exposed shore. To preserve this shore from sea erosion a heavy riprap wall with groins extending from high to low water mark has been built. This, with the various buildings, roads, varying surface of the land and depth of water is shown with minutest fidelity. In our engraving, No. 1 shows location of the bell tower, 2 the Hook beacon, 3 Maritime Exchange signal tower, 4 telegraph station. The model showing Hell Gate (the narrow passage to New York City from Long Island Sound) before improvement gives an accurate idea of that once-dreaded stretch of water, and we can easily imagine the feelings of the early navigators as they were whirled through on the boiling water between rocks that threatened to destroy them on every hand. Before the advent of the first Sound steamer (built by Fulton), trade was carried on by swift sailing packets that left New York so as to pass through Hell Gate with the last of the flood tide. After the successful voyage of the first steamer a regular time for departure was established and it was triumphantly announced that Hell Gate had been robbed of its terrors by steam.

In order to compete with steam the sailing vessels had to risk the passage regularly, and consequently more lives and property were lost after the application of steam than before in running the gauntlet of these obstructions.

In referring to the engraving, No. 1 represents the northern end of Blackwell's Island; 2, Bread and Cheese; 3, Flood Rock; 4, Gridiron and Hen and Chickens; 5, Negro Heads; 6, Little, and 7, Great Mill Rocks; 8, Heel Tap; 9, Rhinelander's Reef; 10, Hallett's Point; 11, Frying Pan; 12, Hog's Back; 13, Holmes' Rock; 14, Pot Rock; 15, Way's Reef; 16, Mussel Shell.

The great increase of traffic after steam was applied to the navigation of Long Island Sound in 1817 called for recognition of its rights to a diminution of the dangers of this waterway, and in 1848 Lieutenants Davis and Porter recommended to Congress the destruction and removal of Pot Rock and Way's Reef, and in 1852 Major Fraser, using Mailiefert's system of submarine surface blasting, began operations.

In 1867 General Newton examined Hell Gate and recommended for the removal of isolated reefs the construction of a cupola scow. This was built the next year and had a well hole 32 feet in diameter and was provided with 21 drills.

It was used on Diamond Reef in 1869, Coenties Reef in 1871, and the Frying Pan in 1872.

The East River makes a right angle at Hallett's Point, Astoria, and another at Negro Point, Ward's Island, and work was begun in August, 1869, to remove the reef at the former point.

A detailed survey made in 1871 of the surface of the reef consisted of the location of 10,000 soundings. By this means the engineers were enabled to regulate the length and height of the headings that radiated from a shaft protected at the top by a cofferdam.

These operations were continued until September 24, 1876, when 52,000 lb. of explosives rent the pillars and roof of the mine.

The rock thus broken up was removed by dredges, and vessels could thus pass 150 feet nearer the shore. The greatest engineering work, involving the destruction of Flood Rock and the minor reefs connected with it, was completed October 10, 1885.

On that day 150 tons of dynamite and rackarock lifted into the air a column of water 1,200 feet long, 700 feet wide, and 200 feet high. A model of part of Flood Rock is shown in our illustration.

It is so constructed that the roof can be raised so as to show the galleries and headings and system of exploding the mine.

This roof in the original of the model was of an average thickness of 15 feet and an area of about 9 acres. It was supported by 476 columns, and the depth of the shaft was 64 feet.

The mine at Hallett's Point was exploded by a system of quick-burning fuses; every cartridge being connected in a series, which was in turn connected with another. In Flood Rock, however, the greater number of cartridges were inserted in the holes, which were then plugged up.

Beams were placed across the main passages from corner to corner of the pillars and connected; and the explosion of these caused that of those embedded in the walls by sympathy.

For eight years dredges have been at work removing the debris caused by this explosion and a depth of 22 feet of water has now been reached. When there is an even channel of 26 feet, the work of dredging will be discontinued. The work of demolition was so thoroughly done by the explosion of 1885 that only occasional blasting is now necessary in order to forward the work of clearing the channel. One of the models shows the appearance of the rock, above the surface before the work was commenced.

There is now a depth of water of 26 feet over all the other obstructions except the Bread and Cheese, which is now inclosed by a sea wall, Hog's Back and Holmes' Rock and Great and Little Mill rocks, which are united by a causeway.

Another extensive work shown by the models is the Harlem River improvement, which consists of the deepening of the channel of Spuyten Duyvil Creek and the Harlem River and the removal of the rocky divide which separates them just below the village of Kingsbridge. This model is remarkable for the completeness and fine execution of details, the tracks of the railroads, drawbridges, signal stations, etc. The depth of the creek and of the cut are presented with exactness, and that part which shows the rock removed from the cut can be lifted out.

These models are carved in wood from the plottings taken by the engineers, and reduced to the different horizontal and vertical scales, each point being verified by reference.

A gelatine mould is then made from which plaster casts are taken, and the parts colored in accordance with the rules of engineering technique.

Where Tin Comes From.

The United States consul at Singapore says that more than one-half the world's tin is mined in the Straits Settlements. The output for the year 1891 was 57,551 tons, against 36,061 tons for the Straits Settlements. If to this 36,061 be added the 12,106 tons, the output of the Netherlands India, whose tin-bearing islands are within a few hours' steam of Singapore, it will leave but 9,384 tons for the rest of the world. Up to the introduction of modern tin mining and smelting machinery in 1889, the tin was worked for a century in a most primitive fashion by the Malays. They simply dug down at the base of a hill, took up the clay which contained the *biji timah* (small nodules), and carefully washed it in running water. When dry, it was smelted in a furnace built of clay between two layers of charcoal, the fire being forced into a glow by means of bamboo bellows. When the metal became molten, it trickled through a hole in the bottom of the furnace into a vessel, from which it was ladled into moulds, forming slabs weighing about 2 catties (2⅔ pounds). A rajah's or chief's wealth was reckoned in bars or slabs of tin. The primitive tin mining of the Malays gave place to the more energetic and thrifty mining of the Chinese, who brought with them better tools and better business methods. The Chinese monopolized the entire field, until the formation of the Jelebu Company, in 1889, with which the Chinaman can still compete.

The Chinaman's manner of working is simple, though thorough. As the float tin lies at a distance of from twenty to fifty feet from the surface, gradually diminishing toward the hill sides, where it is not more than six feet, the jungle is cleared along its source, and water is brought by a ditch from the nearest stream. At about six feet down, the water begins to rise from the soil, and to get rid of this, and also to utilize the water from the stream as a motive power, an ingenious chain pump is made by constructing a long wooden trough of three planks, each 100 feet in length, and this is placed with one end resting on the bank, the other sloping to the water in the lowest part of the mine. A wooden chain, with its small oblong pieces of wood placed at right angles to the line, is fitted accurately into the trough. The wooden chain is endless, and is passed round two wheels, a small one at the lower end of the trough and a large one at the upper end. The latter is a water wheel, and is turned by a constant stream of flowing water. Round the axle of this wheel are cogs, each of which, in turn, as the wheel revolves, draws up a link of the endless chain through the trough, and, as each joint fits accurately into the trough, they bring up in succession a quantity of water, which on reaching the mouth of the trough falls into the channel by which the water which turns the wheel is carried off, and is thus also taken away out of the mine and conducted to the next, when the process is repeated. The small wheel at the lower end of the trough regulates the chain and guides the wooden joints into the trough.

The Chinaman's tools consist of a hoe, two baskets, and a bamboo pole. The soil is scraped with the hoe into the baskets, which in turn are balanced over his shoulders at the ends of the bamboo pole. The washing is performed in much the same way as placer gold is washed in California and the West. The soil is thrown into a trough filled with running water, in which the dust is carried off in solution, and the ore retained by means of wooden bars nailed across the bottom of the trough. While the Chinese system of smelting is similar to that of the Malays, it is more elaborate, and carried out on a much larger scale. In place of the bamboo bellows, a very ingenious plan is adopted. The trunk of a tree, about 18 inches in diameter and 10 feet long, is carefully hollowed out and closed at either end. A long pole, with a circular piece of wood at one end, fitting exactly into the bore of the tube, acts as a piston. In order to secure the tube being perfectly air-tight, the end of the piston is well padded. Valves are placed at each end, to allow the air to enter, and the center of the nozzle of the bellows communicates with the furnace by means of a small air passage. On the piston being drawn out, the air in the higher portion of the tube is forced down the nozzle, and being drawn back, the air in the further part of the tube is similarly drawn into the furnace. The charcoal is soon brought to a white heat, and ready for the moulds. The best of the Chinese mines are found in Laroot, in the northern part of Perak, south of the Siamese State of Quebrada, in a stratum of whitish clay. In some of the tin mines in the neighborhood of the Batang and Padang rivers, small quantities of gold are found mixed with tin.

Consul Wildman says that the Jelebu Tin Mining and Trading Company is the only successful European-managed mining adventure in Malaya, and one of the chief producers of Straits tin.

Fall of an Aerolite.

The Spokane *Review* (Washington) of June 2 contains an interesting letter from Engineer's Camp, on Beaver Creek, B. C., which states that on May 26 last a mereoric stone, or aerolite, exploded in that vicinity, the fragments falling along Beaver Creek, about ten miles above its junction with the Columbia River. At about 4 P. M. on that day there occurred fifteen or twenty short, sharp reports following each other in quick succession. The first report was the loudest, but all were clear and distinct. The noise was heard at Sayward, Waneta, and even at Northport, nearly twenty-five miles away. A party of engineers surveying on the Nelson & Fort Sheppard railway were working in the vicinity. At first they thought the noise was thunder or a railroad blast, but there was no blasting being done within six or seven miles. Following the reports a whizzing sound was heard as if made by some body moving swiftly through the air. They were working in thick, heavy timber, and therefore could see nothing, and no fragments fell close enough to be heard strike the ground. At the time of the explosion a man named J. W. Gerling was walking along the trail up Beaver Creek. He heard it, but at first supposed it to be thunder. A few moments later he heard the whizzing sound above mentioned, and as he looked up to see whence it came, it grew louder and louder, until a stone struck the ground not far from where he was standing. He searched for it a few minutes, but the bushes were so thick he could not find it, and the fragment evidently was small. Ed McLeod, who is building the "tote" road for Contractors Peter Larson & Co., says that the report seemed to come out of the sky almost directly above the place where he was working. A fragment fell within fifty feet of him, and although it buried itself in the earth, he succeeded in finding and digging it out. The specimen would weigh four or five pounds. One or two other fragments were observed to fall and two laborers were very nearly struck by one piece. On the following day Mr. James Hislop, of the engineer corps, was taking topography near where Ed McLeod found his specimen, and while so doing came upon a hole in the earth about the size of a badger hole, and evidently freshly made, as loose earth had fallen back in it. The hole was at about an angle of sixty or seventy degrees. Together with Mr. E. L. McNair and Otto Austin, also of the engineer corps, they made an excavation and at a depth of about three feet came upon a rock weighing about twenty-five pounds, which was exactly similar to the piece found by Ed McLeod. It was taken to camp and is now in Mr. Hislop's possession, who values it highly. Other fragments, and probably larger ones. fell, but as they scattered three or four miles apart, and the country is mountainous and thickly timbered, there is little chance that any more will be found.

Naphthalene as a Timber Preservative.

Naphthalene, which is a product of coal tar distillation, in appearance something like paraffin, has been found useful in England for the preservation of timber. The wood is soaked for two to twelve hours in the melted naphthalene at a temperature of about 200 degrees Fahrenheit.

Composition Paint.

This refers to a composition paint which will not corrode when subjected to the action of water and further renders the material coated waterproof. The paint consists of:

Spirits of wine	1 gallon.
Shellac	4 pounds.
Resin	1 pound.
Steatite	½ pound.
Lampblack	2 pounds.

Instead of lampblack, any other desirable pigment may be employed. The ingredients are thoroughly mixed together, and for 30 minutes subjected to a heat of 212° Fah., and then allowed to stand for 48 hours. The mass is subsequently strained and ground in an ordinary paint mill.

The Pennsylvania Company's New Station at Philadelphia.

At this station, an engineering work of considerable interest is now being carried out by Mr. Percival Roberts, of the Pencoyd Iron Works. At present the station platforms are covered by two arched roofs of moderate spans, but a short time ago the company decided that the width of the station should be increased and placed under one roof, the width of which will be 307 feet clear, a dimension exceeded only by two other famous structures—the Machinery hall in Paris and the Manufactures building at Chicago. It was a matter of necessity that this alteration should be carried out without interfering with the constant traffic of the station, and accordingly the great span is being erected over, and clear of, the existing roofs, which will be removed after the completion of the new structure. In design the new roof will resemble very closely that of the Jersey City station. Large areas of glass in exposed situations, and at a great height above the ground, are a constant source of expense for maintenance, and what is much more serious, a standing danger to the people on the platform beneath. These dangers have been practically obviated by the use of glass moulded upon round steel wire netting. The netting is embedded in the glass, so that fracture becomes practically impossible, and in any case must be limited to very small areas, and no broken glass can fall to the ground. This new glazing material can be bent, and in this way curved skylights can readily be made. The method of making this wire-strengthened glass was illustrated in the SCIENTIFIC AMERICAN of Nov. 5, 1892.

JAPANESE AT THE WORLD'S COLUMBIAN EXPOSITION.

One of the most picturesque parts of the Exposition on opening day, says *L'Illustration*, was the Japanese section, before which the exhibitors had grouped themselves, offering a picture that was truly characteristic of this race, which is gradually becoming Europeanized. Some have adopted modern garments, while others, who are more timid, retain a part of their national costume, but wear shoes instead of slippers, and have English caps on their heads.

REFRACTION AND DISPERSION OF LIGHT.*

Fill an ordinary drinking glass, having a plane bottom, one-third full of water and incline it, as shown in the engraving, so that the water forms a prism. This permits the observation of the phenomena of refrac-

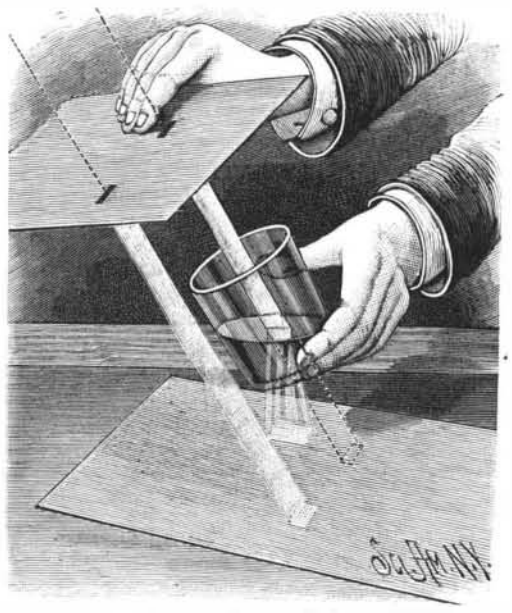
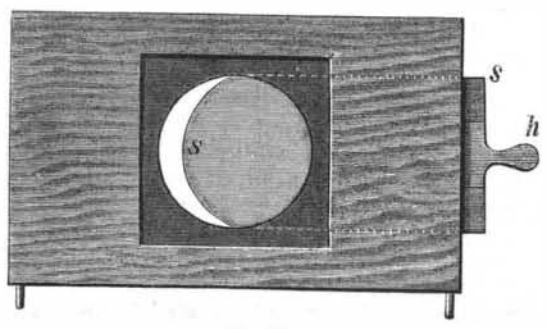


Fig. 1.—REFRACTION AND DISPERSION.

tion and dispersion of light. The experiment may be performed in the sunlight or by means of a lamp in a darkened room. In the first case, a card, having two slits made in the same line, is held over the glass and the glass is inclined so that the rays of the sun pass through it parallel to its axis. The card is held parallel with the top of the glass containing the water. Through one slit the light is allowed to fall on the



Fi~. 2.—SLIDE ILLUSTRATING IRRADIATION.

water in the glass, and through the other upon a piece of white paper placed under the glass. The beam is seen diverted from its course, and upon the paper is seen the spectrum.

The pencil of rays emerging from the glass is thus seen diverted from the path of the incident beam and also dispersed.

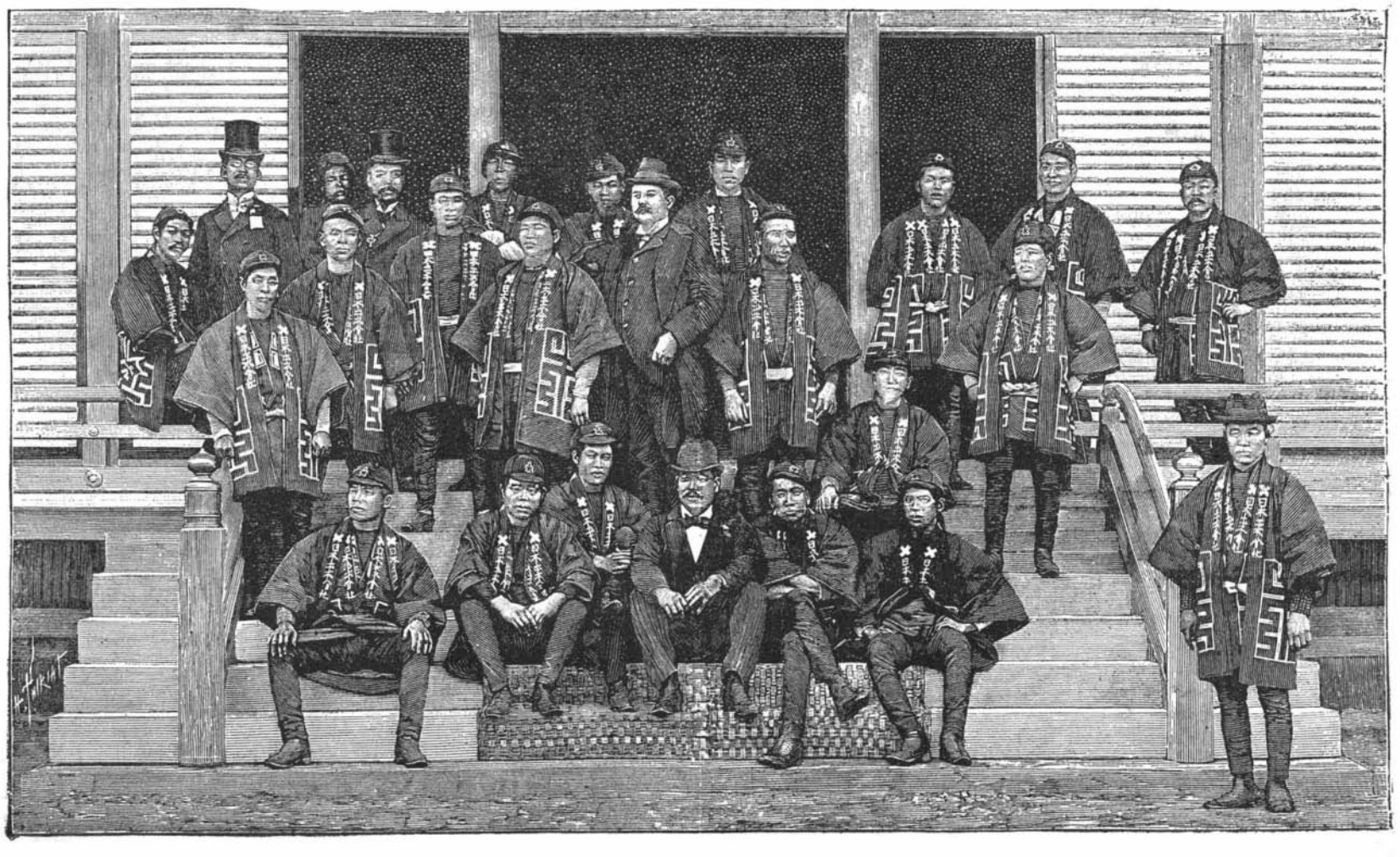
Irradiation.—This phenomenon, which is frequently noticed in observing the new moon, may be demonstrated experimentally by the apparatus shown in Fig. 2. The frame, which is fitted to an optical lantern, carries an opaque plate having a circular opening, before which a slide, *s*, of ground glass or paper, is placed. If this slide is opened only a little way, the outer border of the half crescent appears to be formed on a larger circle than that of the dark part.

Engraving Glass by Electricity.—The glass plate to be engraved is covered over with a concentrated solution of saltpeter and connected with one pole of a battery. A fine platinum point is connected with the other pole. This point serves as a drawing pencil, and the lines traced by it will be found etched in the surface of the glass.

* From the German translation of "Experimental Science."

Photography as an Aid to Art.

At the meeting for the distribution of prizes to the students of the Art Training School, South Kensington, an address was delivered by Mr. W. F. Yeames, R.A. He pointed out that the standard of work required from artists was getting higher every day, the competition, owing to the increase of their number, being also very much greater. Students must always bear in mind that the instruction received in schools was always technical only, and that they were but on the threshold of art when they left the school, and must depend for success upon their individuality. When they entered into their work in the field of art they would come under many influences, and it was on one of these he wished to dwell, that of photography. Photography had done a great deal, especially for art. In one branch it had been an enormous help in the reproduction of the works of fine art throughout the world. Photography was a feature of the age of science and mechanical appliances, and, like all things scientific, dealt in facts. In no photograph did one see any expression of the emotions of the heart; but these were qualities which they, as artists, would have to deal with. In a broad way he would say the art of drawing had improved under the influence of photography, but he would make a slight exception as regards the rendering of human form and face by the great masters. He could not say that photography had excelled the productions of these great men, who had such a keen perception of everything in nature that they were able to produce results that photography had never surpassed. But with nature in general, vegetable life, clouds, etc., photography had brought to light many things not known before. With reference to when and how students should use photography, he said the artist could use it with impunity when his knowledge enabled him to do without its services: that is, a man should be master of photography, and not photography master of the man. Before using it he should be so well grounded in the technique of drawing as to be able to draw any object in nature; photography would then be of much use to him, as it would lighten his labor and extend the range of his subjects. Photography should be used only as an aid to art work.



JAPANESE AT THE WORLD'S COLUMBIAN EXPOSITION.