THE EAST RIVER TUNNEL OF THE EAST RIVER GAS COMPANY.

After two years of the most arduous work, including the solution of some of the most difficult of engineering operations, the tunnel between Long Island City and New York of the East River Gas Company, a tunnel constructed for the purpose of providing a conduit for gas pipes from Long Island City to New York, has been completed. We have before this illustrated the progress of operations; to-day, when the tunnel is completed, some further description of the work will be acceptable.

In April, 1892, the East River Gas Company, of Long Island City, N. Y., received its franchise. The company owns a large quantity of land in Long Island City on which it proposes eventually to construct immense gas works to supply the city of New York, and to send the gas through large transit mains beneath the East River. The tunnel penetrates the two channels of the East River and Blackwell's Island, all of which here intervene between its terminal points. It is 2,516 feet long, and the grade is given a uniform slope, the bottom descending about 12 feet toward the Long Island City end, where there is a sump for collecting the drainage. The western shaft is 135 feet deep, the eastern 147, measured from the street levels. Referred to low water mark, the maximum depth of the floor is 125 feet, which gives a minimum of 41 feet of rock and earth above the tunnel. It was originally hoped that it would be possible to excavate the tunnel in solid rock, without the use of compressed air or any special methods, but four or five hundred feet from the New York end of the tunnel a most vexatious kind of clay, or decomposed feldspar, was encountered. The contractor wished to abandon the work as far as executed, but Mr. C. E. Jacobs, the engineer in charge, undertook by his own exertions to penetrate the soft material. The contractors desired to start anew from the shore, and sinking the shaft lower, to begin the tunnel at a level 50 feet or more below the original tunnel. This, if carried out, might have obviated the difficulty; but if the same soft material had been encountered, the new tunnel would have been absolutely worthless, as the great depth would have precluded the possibility of using compressed air.

Soft ground was also encountered on the Long Island side of the tunnel, so that eventually two air locks were established and the work was prosecuted under compressed air with the Beach hydraulic shield, which has been described in these columns in connection with the North River tunnel and the St. Clair tunnel. A very heavy air pressure had to be used, which rose at one time to 52 pounds, the waste of air being very great, as quantities escaped through the roof of the tunnel, causing great ebullition on the surface of the river above. To determine what lay in advance, horizontal drills were operated through the shield, a distance of 67 feet being penetrated in one case. As the shield advanced, a lining for the tunnel, consisting of flanged cast iron plates, was bolted in place, it having been found that brick were not altogether satisfactory in this ground. The very high pressure of air made the work exceedingly dangerous, and the courage shown by the men in entering the air lock under the conditions and in face of the known danger incurred was not short of that shown by a soldier in battle.

The air lock bulkhead was pierced by a number of pipes for different purposes. Electric light and telephone service extended through to the heading; through one pipe the air for the operation of pumps was received; and an exhaust pipe was also carried through the bulkhead so as to provide a connection for the exhaust of the compressed air pumps. This connection was sometimes used when a great many pumps were working, as it of course reduced the pressure by the amount existing in the space forward of the air lock.

The tunnel as completed is of two different sections. Roughly speaking, in hard rock it is 8 feet 6 inches in height and 10 feet in width, the roof having a general curvature of 7 feet radius. This is the minimum template, but of course, as the walls are rough, the tunnel is really larger than this section, and its walls are very irregular. The floors are to be concreted to a true surface. In soft ground it is of circular section, lined with the iron plates already described, which form a cylinder with external diameter of 10 feet 10 inches, having an internal diameter 10 feet clear of all the flanges.

The tunnel is entered by two vertical shafts, one at each end, each shaft being 9 feet square. One of our illustrations shows the general section of the completed work. The entrance to the tunnel near the gas works is shown in another illustration; a simple aperture leading down into the earth represents the beginning of a work of such importance, difficulty and danger. The rough contour of the completed work in rock has been alluded to. In one of the illustrations we show the completed tunnel in solid rock, lighted by incandescent lamps, and illustrating its irregular section. Another cut shows the progress of the work in soft ground with the Beach shield in the background.

On the evening of Wednesday, July 11, at 7:35 P. M., the first drill penetrated the walls separating the two tunnels, this marking the complete penetration of the river. The diaphragm of rock was drilled on both sides and was charged with a number of dynamite cartridges. They were all connected by wire, the wires from one side being led through the single drill hole, so that both sides were connected in the same circuit. Mr. Charles M. Jacobs, the chief engineer, personally exploded the last blast at 11:50 at night, and immediately he and his assistant, Mr. W. J. Ames, side by side, crept through the opening, and went through the tunnel, being the first human beings to go under the East River channel. As they emerged at the Ravenswood end they were enthusiastically received by the workmen. The biggest day's work done at any one heading was executed at the end of the week June 27, when for the entire week 101 feet were penetrated, an average per day of nearly 15 feet. Two years less one day were occupied in the completion of the tunnel.

The air locks set in Portland cement concrete had to be removed. This was done by blasting. A number of shots were placed in holes drilled in the cement and the work was blown away. This operation is the subject of one of our cuts.

The work was in charge of Mr. Charles E. Jacobs, Mem. Inst. C. E., Mem. Inst. M. E., with Mr. J. Bipond Davis as chief assistant.

The tunnel was constructed in two sections, one advancing from the New York end, the other from the Long Island end. The accuracy of the alignment of the two sections was such that when they met a deviation of only one-half inch existed. This was done on base lines of but eight feet length.

Highly Sensitive Collodion Emulsion.

Dr. David, of Paris, has succeeded in preparing a bromide of silver collodion emulsion, the sensitiveness of which increases gradually to 22 or 23 degrees Warnerke.

The method adopted is as follows: Upon a horizontally adjusted glass plate, size 18 by 24 cm., are poured 25 c. c. of collodion, which contains per liter 18 grammes of silver nitrate and 7 to 8 grammes of pyroxyline. After the film has coagulated sufficiently, it is changed to a bromide of silver film by treatment with the following bath:

Potassium bromide	80 to 120	grammes.
Potassium iodide	0·01	"
Gelatine	2	"
Distilled water	1,000	c. c.

A completely opaque film must be obtained. It is sensitized by leaving the plate for a longer or shorter time in the following:

Potassium bromide	18 to 25	grammes.
Gelatine	1	"
Distilled water	1,000	c. c.

The sensitiveness increases with the duration of action and the temperature of this bath. At a temperature of 70 to 75 degrees Cent., the time of action must be about two hours; at 90 to 95 degrees. about one hour.

Upon looking through the film, it will be observed that the grain becomes gradually larger until the granularity is distinctly visible to the eye. Accompanying this increase in the size of the grain is an increase in the sensitiveness of the film.

After the plate has reached the desired stage, it is washed and dried. Contrary to what might be expected, the collodion film does not exhibit the slightest tendency to leave the plate at a temperature of 100 degrees Cent., provided that the surface of the plate has been thoroughly cleansed.

Plates prepared in this way can be developed very quickly, washed and fixed. The negative is ready for printing in ten minutes. Varnishing is unnecessary, as the collodion film is very hard.—*Photographisches Archiv.*

Microbes in Bread.

According to the British *Medical Journal*, Dr. Troitzki, writing in the Russian medical periodical *Vratch*, states, according to *Nature*, that he has found that new and uncut bread contains no micro-organisms, as the heat necessary to bake the bread is sufficient to kill them all. As soon, however, as the bread is cut and is allowed to lie about uncovered, not only harmless but also pathogenic microbes find in it an excellent nutrient medium. White or wheatmeal bread is a better medium than black or rye bread, as the latter contains a greater percentage of acidity. Dr. Troitzki's experiments with pathogenic bacteria gave the following results: *Streptococcus pyogenes aureus* retains its vitality on the crumb of wheatmeal bread for twenty-eight to thirty-one days, on the crust for twenty to twenty-three days; the bacillus of anthrax (without spores) remains alive on the crumb for thirty to thirty-seven days, and on the crust for thirty-one to thirty-three days; the typhoid bacillus remains active twenty-five to thirty days on the crumb, and twenty-six to twenty-eight on the crust; while the bacillus of cholera lives twenty-three to twenty-five or twenty-seven days on both.

Collogravure.

BY HECTOR KRAUS.

Under this name, M. Balagny, of Paris, a Frenchman, has invented and published a novel process of producing collographic prints in fatty inks, which is claimed to be very simple and easy to execute, while no special apparatus of any kind is necessary to work it.

He makes use of a special flexible film of his own invention, which is manufactured for him by the house of Lumieres Bros., in Lyons. These films are made on a paper or similar flexible support, which is coated with the regular bromide of silver gelatine emulsion like any dry plate, but has received a previous special preparation or coating of his own invention for the purpose of making the sensitive gelatine film very strongly adhere to its support. Without this precaution the gelatine film would have a tendency to separate and peel off under the action of the roller when the finished plate is ready to be inked. The writer has experimented and tried this new process with good success by using the enamel bromide paper made by the Buffalo Argentic Paper Company. This paper would be excellently adapted to it, but unfortunately the adherence of the film to the paper did not prove to be sufficient, and it came off under the roller.

What is especially characteristic of this ingenious process is the rapidity of all its operations. It is possible to obtain a print by this method in thirty minutes.

The following contains the mode of operation: The paper or films are cut to the desired size, and are immersed one by one into the following bath:

Water	100	parts.
Bichromate of potassium	3	"

They are left in this bath to absorb all the liquid they are susceptible to, which takes from five to ten minutes, according to temperature. The sheets are then removed from the bath one by one, and placed film side down on a plate of thick glass. With a rubber or squeegee the excess of the liquid is now thoroughly squeezed out, and the back mopped off with a soft rag or sponge. In this condition they are left on the glass during three to five minutes; they are then removed from the glass and carried to the dark room, or put in a box where they are allowed to dry in complete darkness. In this condition the films keep well from six to eight days, but they must be carefully guarded and kept from actinic or day light.

For printing, the ordinary printing frames are used. The negative should be covered with a mask of black or opaque paper to protect the margin of the film about a quarter of an inch all round from the action of the light, the same as in carbon printing. The presence of bromide of silver accelerates the printing considerably and makes the time of exposure a very short one. After all the details are visible, or, in case of transparent films, when the deep shadows are plainly visible on the back, the film is removed from the frame, placed face down against a piece of black cloth or felt, and exposed from the back from thirty seconds to one minute, but never in sunlight. The films are now washed out in frequent changes of cold water until all the bichromate is thoroughly eliminated. They may remain in the water until the next morning. They can also be printed directly after only five minutes' washing, but then the resulting pictures are not so fine and deep. The films are finally fixed in: water, 100 parts; cyanide of potassium, 5 parts; and rinsed again for ten minutes. Before printing they must be mounted on zinc plates. These should be polished and well cleaned. The surface is then poured over with spirits of turpentine, and wiped off with a special rag. The grease left by the turpentine is then removed by passing over the surface of the zinc a sponge imbibed with water 10 parts, silica of soda 3 parts, and rinsed under the tap, but without touching the surface. A piece of gelatine film, such as is sold in sheets ready made, is dipped in water, placed on the zinc and pressed in contact with a roller. The printed film is then taken out of the water and placed on top of the plain gelatine film and also squeegeed in contact with the roller, carefully avoiding foreign bodies and air bubbles. We have then a combination of three surfaces: zinc, a sheet of plain gelatine, and the film carrying the image, entirely connected and kept together by atmospheric pressure. The adherence is perfect. The mounting can also be accomplished in the following manner: by simply squeegeeing the film to a piece of gelatinized parchment paper, such as is used with the apparatus called the photoautocopyist and fastening the whole on the special stretching frame connected with this apparatus.

The surplus moisture is next carefully removed with a soft rag and then flowed over with a twenty per cent solution of glycerine in water, which is left to penetrate the film well, and then removed with a sponge. The remaining moisture is again blotted off with a rag, and the plate is ready for inking. This has been described so often that it will be unnecessary to repeat it. The prints can be made in any kind of a press, even in a letter copying press, but in this to obtain a uniform pressure a sheet of thick rubber must be placed on top of the paper which receives the print.—*Photo. News.*