FINAL OPERATIONS FOR THE REMOVAL OF FLOOD ROCK.

Flood Rock, a ledge of gneiss situated about one-quarter of a mile from Hallet's Point, Astoria, L. I., is one of the most formidable of the many obstructions by which all the commerce passing through Hell Gate has been menaced. This rock forms a very irregular obtuse cone, only a small portion of the apex of which comes above water. This formation and its location in the bend of the river almost in the center of a swift current at each change of the tide make it an object of great dread to pilots. The work of removing this rock was begun in 1875, and after unnecessary and costly delays caused by the failure of Congress to appropriate sufficient money from year to year the entire excavation has been completed, all the drill holes have been bored, and all that remains to be done is the charging of the holes with explosives, removing the plant, and dredging the broken rock after the firing. The total cost of the improvement will be about $1,000,000.

The method pursued may be briefly described, the familiarity of our readers with the undertaking rendering a detailed account uncalled for. A shaft was sunk at the highest point of the rock to a depth of 60 feet below water level, and from this shaft galleries were extended parallel with and at right angles to the current. These galleries are 25 feet between centers, and extend under all the rock to be removed. It was not the design to remove the rock as much as possible by means of these tunnels—owing to the fact that it would be cheaper to dredge the broken rock after the explosion—which were only expected to serve as passageways honeycombing the rock and through which access could be had to all parts in order to place the powder. Absolute regularity in the spacing of the galleries could not be maintained owing to inequality in the texture and formation of the rock. The plan view in the accompanying illustrations shows the present condition of the excavation, and, being drawn to scale, it presents a good idea of the magnitude of the work.

Thus was formed an immense chamber, averaging about 10 feet from floor to ceiling, having a stone roof averaging about 15 feet in thickness and supported by 467 rugged and massive columns. In this chamber, running parallel with the East River, are 24 galleries, the longest measuring 1,200 feet, and running at right angles to the stream are 46 galleries, the longest of which is 625 feet. The area covered by the chamber is about 9 acres. The aggregate length of the galleries is 21,670 feet.

The mining operations were not attended with unusual risk either to the men or the work; the main danger was from the flooding of the mine through the opening of a fissure, or the meeting with a rock "keyed the wrong way," which would admit the water in quantities too great to be handled by the pumps. Fissures were frequently encountered, but fortunately none of excessive size; the large holes were plugged with wood, loose filling, such as cement, being unavailable because of the great pressure of water, some 26 pounds to the square inch. To escape the drippings and in some cases the pourings from the roof, and to enable the visitor to walk dry shod through the small brooks running down some of the galleries, he is, through the kindness of those in charge of the work, encased in rubber from head to foot.

The northeastern portion of the excavation, having an area of about one acre, was through rock very irregularly fissured, and as the roof approached closer to the bed of the river great care was exercised in driving the headings; in some places it was found expedient to support the roof and sides with heavy timbers, as shown in Fig. 2. In order that the caving in of any part of this section should not flood the main work a strong door (Fig. 3) was early built in the gallery connecting the two sections. Attached to the outer edges of this door is a rope, leading over a pulley in the casing and along the gallery to the shaft; the door can thus be easily and quickly closed, should it become necessary at any time to shut off the weak portion of the work.

Thirteen thousand two hundred and eighty-six holes have been drilled in the columns and roof, the holes being 3 inches in diameter and having an average depth of 9 feet; these holes, if placed end to end, would reach over 22 miles. During the progress of the work an accurate plan was kept, showing the location and number (Fig. 7) of each hole, together with its inclination and depth. Fig. 6 shows this hole plan for one column—the shaded portion—and the adjoining galleries, the centers of which are represented by the dotted lines. The holes in the columns are about 5 feet apart, and extend upward at an angle of about 45 degrees; the holes in the roof are about 4 feet apart, and are at an angle of 60 or 65 degrees. No holes were drilled near the floor. Each hole will be filled partly with "rackarock" powder and partly with No. 1 dynamite. The form of the cartridge is shown in Fig. 8, the projecting wires shown at one end being intended to hold the cartridge in position in the hole. Fig. 5 shows the method of charging the holes. A small car is provided with several frames, made to fit on top of the car, and each being about the size of the car; the frames can be placed as needed, one on top of the other, thus furnishing a platform from which the holes in the highest galleries can be reached. The track consists of two movable sections, about 15 feet long. Should no delay occur, it is expected to complete the charging of the holes by the first of October.

The next operation will be to remove all the machinery and buildings, and the top of the island down to the water's edge. Of course, much of this work can be done during the time of charging. The mine will then be flooded and the charge exploded by means of electricity.

The engraving, Fig. 1, shows the drainage ditch or deep gallery, extending across the mine a short distance north of the shaft. The longitudinal galleries cross this ditch, which at the point shown in the cut is some 35 feet from the floor to the roof, by wooden bridges. Extending around the southern part of the mine and along the eastern extremity is a second ditch, connecting with the first; a third ditch leads from the eastern side to the sump, just east of the main shaft (Fig. 9), where pumping engines having a capacity of 4,000 gallons per minute are located. This plan of draining the mine by means of a ditch around the extremity was made necessary by the slope of the river bed; in order to leave sufficient rock in the roof, the galleries slope downward from the center.

The work was planned and has been carried forward by Gen. John Newton, Chief of Engineers U. S. A. We are indebted to the courtesy of Lieut. G. McC. Derby, superintendent of the work, for the privilege of examining the mine, and for data.

Railway Economy.*

There is little risk in saying that there is nothing in this world less understood than the true inwardness of economy. It is not economy to save a dollar when it costs $1.50 to accomplish this saving, and yet this is the method that is practiced to a great extent by individuals and corporations. To a certain degree a little false economy is admissible, but this applies to individuals who undertake to do business with limited means and with a hope to make things more substantial and safe in the near future. It is vastly different with a corporation that has unlimited means, and uses inferior material because it can be bought for a merely nominal sum as a matter of economy. Too much economy has been the death of more people than were destroyed in Buddensiek's buildings, and some of our American railways have been great sufferers by it.

Some years ago it was considered economy to use steel rails in place of iron, and that was true. For a time we had good, honest steel rails, and they were durable and safe, and notwithstanding their excessive cost, it was considered economy to use them. But after a time the ingenious rail maker discovered a way to work in slag and cinders, and make a steel rail much cheaper than a good iron rail could be made for. The rail makers could hardly be blamed for this, inasmuch as railway officials refused to pay a good price for a good article, but gave contracts to the lowest bidder regardless of quality. Not long ago a gentleman was negotiating for a position as superintendent of a rail mill, when he was questioned very closely as to the amount of slag he could work into a steel rail. The desire to manufacture shoddy railway material did not originate with the manufacturers. The railway officials, by their refusal to pay fair prices for honest, good material, have forced manufacturers to make use of all the tricks known to the trade and to invent new ones, and this has been practiced to such an extent that the steel rails now coming into general use are far inferor to third class iron rails.

Steel rails are put forth in all the railway advertisements as an element of safety, and people embark on a steel rail track with a feeling of security; whereas if they knew they were riding on an iron rail track, they would feel decidedly uneasy and unsafe. The truth is, broken rails are becoming more frequent, while we should reasonably expect that accidents from broken rails would diminish as steel rails are put in use. A poor steel rail is not as good as any kind of an iron rail, and the economy that supplies them is very thin. It is rather expensive to provide good, honest rails, but it does not cost nearly as much to lay a track with good rails as it does to fish a train out of a ditch every few days.

And aside from rails, there are other fixtures and appliances that are of very inferior quality purchased under the same false economy that inspired the purchase of shoddy rails. I have examined piles of broken rails, links, pins, wheels, and axles, and have never been able to discover a fracture in good, honest material. It is true that defects will escape the watchfulness of the most vigilant inspectors, but the failures of good, honest appliances are rare. I have seen piles of new links and pins that were made on contract at ruinous prices for good material. I have taken links and pins out of these piles, and with a single stroke across an anvil broken them like a piece of cast iron. The business of the manufacturer was to deliver them and get his pay for them, and the quality corresponded with the price.

Some railway officials plead poverty as an excuse for providing cheap material. This reminds me of what Horace Greeley said in a speech at an agricultural fair. He said that a wealthy farmer could afford to do some very slovenly farming, but a poor man could not. The idea was that the wealthy man would not suffer by his indiscretion, whereas a poor man would get poorer by reason of his slack attention to business and slipshod way of doing it. When we find a successful business man, we naturally think that he gets the best the market affords. Why do not corporations do the same, and get the best? The motto should be with every railway official, "Get the best."

There is no place where folly is more exemplified than in the purchase of railway supplies. Too much legislation is not good, but we, the people of the United States, wish to have it enacted that no railway or other corporation shall build or operate any road unless constructed with good, honest material. The worst economy in this world is buying poor railway material, and the most successful roads are those that have always been thorough in their equipment and repairs.

There is nothing that will put a railway into the hands of a receiver sooner than a thorough practice of the kind of economy under consideration. Look into a keg of spikes bought at less than bottom prices, and you will see many of them without heads and more without points; many of them burned in two, and but very few in a keg will stand driving, and if they do, the heads soon break off, and they become worse than useless. Splice bar and bolts of inferior quality are purchased at low rates, while cheap and dirty lubricants cause hot boxes, cutting of expensive bearings, and trouble generally; cheap wheels, cheap axles, cheap running gear and brakes, cheap fuel, cheap bridges, cheap ties and drainage, cheap pegs and switch fixtures, cheap and overworked employes and operatives, and cheap everything, all of which have, combined, produced nearly all the serious railway accidents on record. "Failure of track and equipment" is the verdict in a large share of the accidents that are recorded, and it is safe to say that 90 per cent of all railway accidents are the result of too much so-called economy.

Not long since the writer was in conversation with a railway official, and the former mentioned the fact that some roads which he named rarely met with an accident, while others were always in trouble. "Yes," said he, "the roads you mention are abundantly able to use first class material and keep everything in first class condition, which prevents accidents." Now, the fact in the matter is that the roads named as free from accidents were as poor in their early days as any roads in the country, but the managers thereof made it a rule to get the best, and preferred to pay liberally for safety appliances rather than drain their treasury on damage accounts. It is not the amount of traffic that fills the till so much as the amount saved by preventing accidents.

Any one who will take the pains to look into the financial condition of American railways and get a correct history of their management, will not fail to notice that those that are the most popular, and pocket the largest percentage of earnings, are those that have been kept in the best possible condition for safe traffic regardless of expense. He will also notice that the roads that furnish shoddy material, and are impoverished by the disasters resulting therefrom, have a weakness for costly private palace cars for the officials, and thus, with railways as with individuals, poverty and style go hand in hand. It is time a reform was inaugurated in this matter, and some genuine economy practiced. We have had too much false economy, and want a change.

* Wm. S. Huntington, in the *American Railroad Journal.*

A New Use for Toads.

The latest and most ingenious way of getting rid of roaches and water bugs we have heard of, is related of a citizen of Schenectady whose kitchen was infested with them.

A servant, hearing that toads were an antidote, caught three ordinary hop toads, and put them in the kitchen. Not a roach or water bug, it is stated, can now be found in the house. The toads have become domesticated, never wander about the house, and are so cleanly and inoffensive that there is no objection to their presence.

Another use for toads is to employ them for insect destroyers in the garden. They are determined enemies of all kinds of snails and slugs, which it is well known can in a single night destroy a vast quantity of lettuce, carrots, asparagus, etc. Toads are also kept in vineyards, where they devour during the night millions of insects that escape the pursuit of nocturnal birds, and might commit incalculable havoc on the buds and young shoots of the vine. In Paris toads are an article of merchandise. They are kept in tubs, and sold at the rate of 2 francs a dozen.

Chemical Colors.

There is nothing to which chemistry has been applied which is more wonderful than the results which have followed the utilization of common gas or coal tar.

Thirty years ago the refuse of the retorts in gas works was utterly useless, and manufacturers did not know what to do with the material. Practical chemists were then applied to, and one of their first achievements was to discover that naphtha could be extracted from this refuse. After the naphtha was extracted, the tar was left, in the form of a heavy oil, and this was still more of a nuisance than the original compound. Faraday next awoke interest in coal tar by his discovery of benzine as a product of the tar oil.

In the year 1857, however, Perkins made a wonderful discovery. He found that it had aniline properties, and this discovery has almost revolutionized the trade in dyestuffs. These he found were capable of producing, under a different chemical reaction, the most brilliant and gorgeous dyes. This discovery made the long detested coal tar a most desirable product of the retorts, and then a valuable solvent for India rubber was made out of the material.

After these properties were extracted from the tar there were left heavy oils, and a residuum for which chemistry was puzzled to find a practical use. It was not until 1869 that any satisfactory result was obtained by experimenting on this refuse, and then the great discovery of alizarine was made. The importance of this discovery may be understood when it is known that in the first ten years following the introduction of the artificial alizarine into the dyestuff trade it exceeded the total amount of natural alizarine, or madder root Thousands of acres of land that had been used for growing madder were saved for corn and other cereals.

This material is shown in many forms at the Inventions Exhibition, and there is no more instructive part of the display than that which contains the stands of the various manufacturers who are producing this composition. In one part may be seen a mass of black, filthy-looking rubbish, and close by tubes of the most brilliant dyes, which are extracted from this refuse. A diagram is made to show in a graphic manner most of the products which this system of utilization is capable of giving. We have an idea that alizarine may be adopted with great results in the manufacture of printing inks, and would advise any one with a turn for chemistry to investigate this subject. It is only a few years since the discovery of a cheap oil completely revolutionized the printing ink trade, and gave us good inks at prices previously unheard of. Similar changes may still be in store, and if this useful product could be thus utilized, a fortune would await the successful experiment.

We have adduced this instance simply to show that all kinds of scientific knowledge can be made of use to the practical man. If space permitted, we might draw illustrations from the circle of all the sciences. No more useful result could follow the extremely successful exhibition at South Kensington than the drawing attention of artisans to inventions outside their own particular craft, and to show them that every species of knowledge may be brought to bear on their everyday vocation.—*Printer and Stationer.*

A New Incandescent Lamp.

Mr. Max Muthel has patented in Germany an incandescent lamp which possesses the advantage of requiring no vacuum in the globe. He has very ingeniously overcome one danger that experiments of this kind have hitherto presented, and that is the fusion of the incandescent wire. The wire used by him consists of a mixture of bodies that are conductors and non-conductors of electricity.

He takes magnesia, silicate of magnesia, etc., and porcelain clay, and forms a fine thread of them which he heats to incandescence and saturates with a solution of platino-iridium salts, and afterward raises several times to incandescence in order to reduced the absorbed salts to a metallic state. Instead of the foregoing mixture, filaments of clay may be taken and saturated with a solution of a metallic salt, which is then reduced to a metallic state through incandescence and the use of oil of lavender or some other organic substance, or through an electric current. With wires thus prepared fusion is absolutely overcome, the presence of the non-conducting substances preventing the metallic parts from melting. Mr. Muthel supposes that the electric spark jumps, so to speak, from one particle to another. and in this way causes a heating of the other substances, which, brought to incandescence, emit a more intense light.

In order to make the filaments stronger, they may be covered with chrome, the melting point of which is still higher than that of platinum. To effect this, the filament is placed as an anode in a bath of chloride of chromium.—*La Lumiere Electrique.*

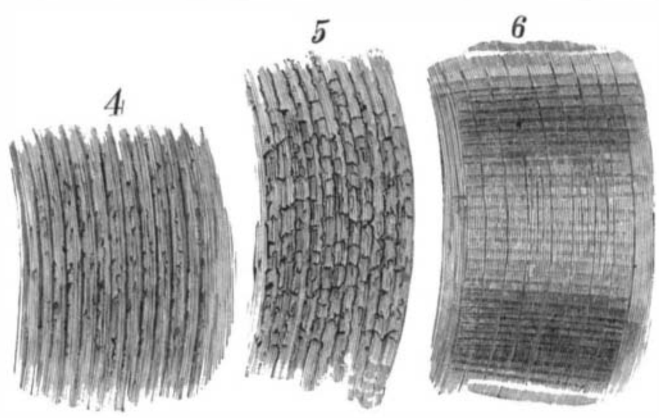
THE MICROSCOPE IN THE MECHANIC ARTS.

BY GEO. M. HOPKINS.

Without, for the present, taking into consideration the pleasures springing from the use of the microscope in its application to the study of the exquisite works of nature, let us see how the microscope may be applied to advantage in the mechanic arts, with the hope that its usefulness here may finally lead to something higher than its mere utilitarian application.

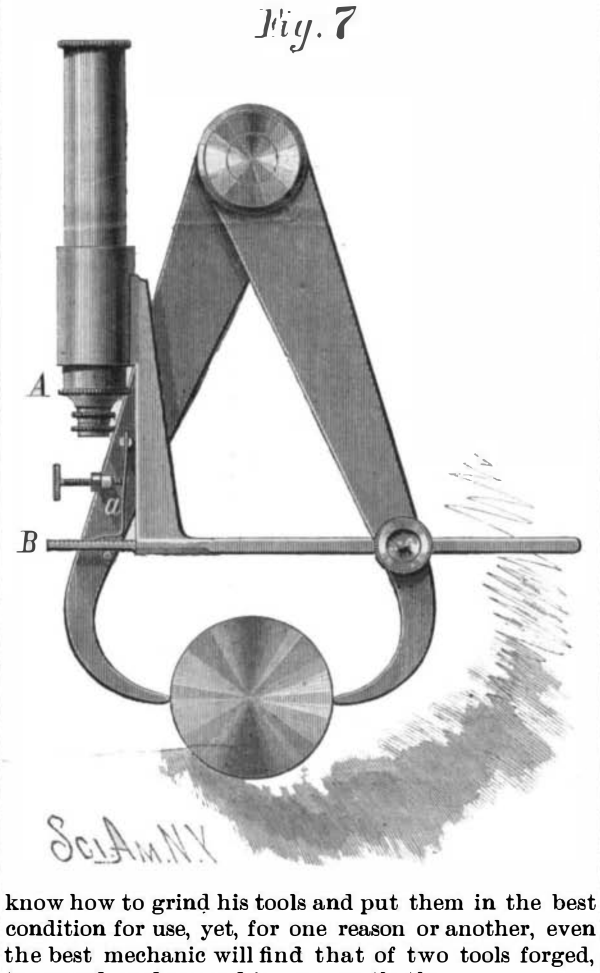
When line shafts were made of wood or cast iron, hexagonal or octagonal in form, with unbored wheels fitted with wooden or iron wedges or keys, and when other machinery was made in an equally crude way, and an eighth of an inch was considered a minute quantity, to have talked of the application of the microscope to mechanical work would have been as inappropriate as would be the application of the microscope of a few years ago to the high class of work of which the recent instruments are capable.

But in mechanics, and in optics, and in every other branch of scientific and practical work, great advances have been made, so that the highest perfection can be reached only by the employment of all available means for securing that perfection, and the use of instruments capable of revealing the minutest defects. The microscope has its application in mechanics not only to the finer measurements, and to the inspection of the quality of work, but its most useful application, perhaps, is to the selection of materials and the study of their behavior under different conditions.



Beginning with metal working tools and their action upon materials; while every machinist is supposed to know how to grind his tools and put them in the best condition for use, yet, for one reason or another, even the best mechanic will find that of two tools forged, tempered, and ground in apparently the same manner, one tool will work much freer, will cut cleaner, and do better work than the other.

Fig. 7



Now, it must be admitted that the portion of the tool that really does the work is microscopic in its dimensions, and a comparison of two such tools by the aid of a microscope will reveal the cause of inferior work with one tool, and the reason of good work with the other tool. The character of the cutting edge depends altogether upon the temper of the tool and the means and methods employed for sharpening it. A tool ground upon a coarse emery wheel or grindstone will be merely serrated. If the emery wheel or grindstone happens to be out of truth, the cutting edge is liable to be rounded. If the cutting edge is produced by a true wheel, and finished by means of a fine oilstone so that a clean, sharp edge is secured, the tool will not only turn out better work, but its edge will be found very much more durable than one of a serrated character.

These peculiarities of the cutting edge can be seen to some extent with the unaided eye, but of course the microscope reveals their defects or their perfections to a far greater extent. The microscope for this purpose need not be necessarily one of the expensive sort; such a microscope or magnifier as any machinist may carry in his vest pocket will answer the purpose, although a larger and better instrument will often be found very useful.

Fig. 1 shows the edge of a diamond pointed tool as it appears under a magnifying power of about 20 diameters, showing the serrations produced by an ordinary coarse emery wheel.

Fig. 2 shows the same tool ground upon an emery wheel which is out of truth.

Fig. 3 shows a tool of the same form under the same magnifying power, the edge of which has been properly sharpened with a fine oilstone after grinding.

Fig. 4 represents the action of the tool shown in Fig. 1 upon its work; the surface of the steel turned with such tool is there shown covered with many grooves and needle-like projections.

Fig. 5 represents a piece of work under the same magnifying power, which has been done with the tool shown in Fig. 2. The microscope clearly shows that the metal, instead of being cut off, is simply bruised off.

Fig. 6 represents a piece of work done with the properly ground tool. The surface of this work needs no further finish; it is absolutely true and perfect, and would not be benefited in the least by the application to it of a file or any abrading material.

What has been said with regard to the diamond pointed tool shown in Figs. 1, 2, 3, may be said with equal propriety about tools of other forms.

Every foreman or superintendent of mechanical work knows how difficult it is to find a workman who is competent to perform the apparently very simple operation of calipering. It is not common to find ordinary machinists who are sufficiently accurate in this matter to carry on their own work by calipering merely, and it is entirely out of the question for one machinist to adjust calipers for another machinist to work by. The difference of touch between the two workmen may result in a difference of between the 1-5000 and the 1-100 of an inch.

To render the operation of calipering more positive, and to establish uniformity in calipering, the microscope, A, together with a micrometric scale, B, graduated to 5000ths, may be applied to calipers as illustrated in Fig. 7. When the workman has calipered his work in the usual manner, his personal equation, if such an expression may be used in this connection, may be discovered by noting the amount of spring of the calipers as indicated by the adjustable index, *a*, carried by one leg of the calipers over the scale, B, carried together with the microscope by the other leg, and other workmen using the same calipers will, of course, reduce his work to such size as will give the same indications under the magnifier. This will permit of great accuracy in the calipering or the measurement of work.

Coal Ashes for Heavy Soils.

A writer in one of our agricultural contemporaries says that for the purpose of making stiff soil friable, sifted coal ashes, where they can be readily had, are better than sand. They are more easily disseminated through the mass, and contain a small proportion of mineral salts likewise, though their merit is principally mechanical. I had a patch of clay over trap rock that, after a rain, took on the consistence of putty. I could do nothing with it. Vegetable manure it scorned, and the spade cut in it as though it was skim milk cheese. The place was made the receptacle of the winter's ashes. Two years after, it was dug up through a mistaken order in the fall. Next spring I manured it, and had it dug over. Then I planted it, of all things in the world, with melons. They were a striking success. More than that, the friability of the soil remained permanent.