THE USE OF EXPLOSIVE PROJECTILES.

Communicated.

The Russian government has issued a circular calling upon foreign powers to adopt unanimously a new regulation, calculated, it is supposed, to mitigate the horrors of war. Hollow projectiles have been devised suitable for small fire-arms. These balls are filled with fulminating material, and in bursting are said to produce effects much more terrible than those of ordinary bullets. Experiments, rather extensively conducted, have proved that these shells can be fired from muskets with the same facility as those of a larger size can be discharged from cannon. As yet these projectiles have been directed chiefly against wild beasts, and basing its statements, let us trust, upon this use of the new shells, the Russian document says, "An explosive bullet of this description splits into ten or more fragments, and in case of the explosion occuring in a man's body the wound is most painful and mortal. Moreover the fulminating matter seriously affects the organism of the human frame and needlessly increases the suffering" The disabling of an enemy, it argues, not the infliction of agony, is all that is desired in actual fight, and the use of these bullets is therefore unnecessary and barbarous.

Whatever may tend to the mitigation of suffering in war is certainly most desirable; but, while we are inclined to give all due credit to the humanity of sovereigns and rulers in general, and of the Czar in particular, we very much doubt that this appeal to the heart will have any weight in deciding the acceptance or rejection of the proposal. So long as evil passions exist among individuals in private life, and these passions, acting on a larger scale, tend to produce distrust, antipathy, and war between nations, a wider and more comprehensive view must be taken of the case. At present the ability to undertake and sustain a war is considered the surest guarantee of a nation's peace. In war it is a received axiom that offence is the best means of defence. If, then, it could be proved that a body of men provided with this kind of ammunition could send more certain and rapid destruction into the ranks of enemies than they would be able to do if furnished with the usual kind, feelings of humanity for the after sufferings of the fallen would not ultimately call forth any prohibition of its use. We think there are certain objections, however, which stand in the way of these shells being extensively employed in warfare. Their use involves more caution and difficulty than that of the common projectile. Numerous unavoidable situations will readily occur to the mind where they would be more dangerous to friend than foe. Again, considering the nature of their structure and composition, it is not easy to see how they can be well employed with the needle gun. Taking these practical disadvantages into consideration, it will readily be perceived how the benevolent sentiments of those who wage war at the expense of their fellow men can remain undisturbed in deciding upon the rejection of these missiles; and no doubt the sagacity of the Emperor of the French led him at once to perfectly comprehend the matter in all its bearings, when with his accustomed policy he so promptly forwarded his assent to the proposal of Russia.

Over and above what at first meets the eye in this proposal, taken in connection with the general acquiescence which will be probably given to the proposition, it seems to us to have an important significance. On sea and land the art of war has arrived at a high degree of perfection. Ships, guns, and war material as a whole have been so altered and improved under the labors of the engineer, the chemist, and the machinist that war is no longer so much a matter of chance as to amount to an exciting national diversion. Death now reaps too enormous a harvest with awful certainty and speed, for nations to sacrifice in war their youth and strength and intelligence on any other ground save the preservation of life, liberty, and national existence. Aggressive wars tend now to something else than the mere gratification of pride and ambition. Princes and potentates are beginning to have these facts forced upon their attention, and, to put it in rather homely but expressive terms, are learning to calculate the "cost of the candle" before venturing on the game of war. Let inventors go on perfecting implements of destruction and devising new ones, for humanly speaking, we know of no other means which can so powerfully operate in showing the folly of armies meeting for slaughter, and forestall in some degree the time when men shall learn the art of war no more.

Artificial Granite.

A method of manufacturing artificial granite has recently been patented in England. The materials of this artificial granite are disintegrated natural granite mixed with clay, together with pounded glass, lava, and iron slags. The disintegrated granite is obtained by submitting fragments of natural granite to a strong heat, about 700 deg. or 800 deg, C. in an oven, by which after a sufficient time, it becomes dissolved into a granitic sand, the constituent parts of which, quartz, or feldspar, possess great powers of adhesion. One part of this granitic sand is then mixed with an equal quantity of pounded glass, or the constituents of glass, or lava, or iron slag, to which is added from twenty to thirty parts of refractory clay, or from thirty to fifty parts of ordinary clay. This mixture is thoroughly kneaded together with a sufficient quantity of water to make it of a pasty consistency. It is then molded to any form required, and submitted to a degree of heat sufficient to vitrify the mass for about thirty-six hours, which converts it into a durable substance resembling granite. The artificial granite thus produced may be molded into any forms required to render it suitable for various kinds of buildings, fortifications, docks, and other engineering structures, and particularly for all kinds of pavements, for which its great hardness renders it particularly suitable. When very large blocks are required, it is preferable to make them hollow, and, after they have been baked or burnt, they may be filled with concrete, rubble, &c., to make them solid. Any kind of furnace in which the requisite heat can be generated will answer for dissolving the granite and baking or vitrifying the blocks or bricks; but Mr. Parsons finds Hoffman's annular furnaces performs this operation satisfactorily.

Correspondence.

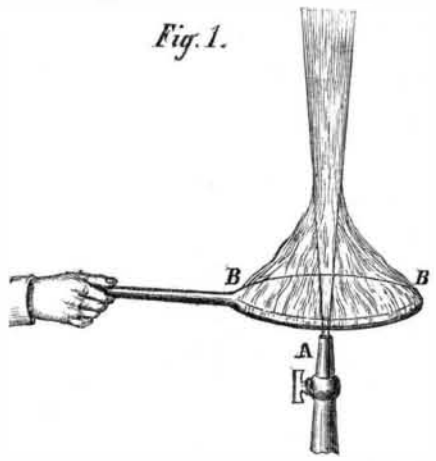
The Editors are not responsible for the opinions expressed by their correspondents

Faraday on the Ball and Jet.

Messrs. Editors:—The following is an extract from an English work:

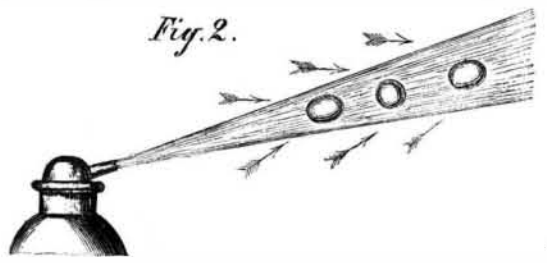
Faraday found that "if steam, at a pressure of about sixty pounds per inch, is allowed to escape from a proper jet, and large lighted circular torch, composed of tow dipped in turpentine, held over it, the course of the external air is shown by the direction of the flames, which are forcibly pulled and blown into the jet of steam with a roaring noise, indicating

Fig. 1.



the rapidity of the blast of air moving to the steam jet." A, in the sketch, (Fig. 1,) is a steam jet, B B, the lighted torch, held around the escaping steam—the flames all rushing into the steam. Egg shells, empty flasks, India-rubber, or light copper and brass balls are suspended in the most singular manner inside an escaping jet of high pressure steam. Sin-

Fig. 2.



gular is the fact that the jet of steam might be inclined at any angle between the horizontal and perpendicular, and still hold the ball, egg shell, or other spherical figure, firmly in its vapory grasp, as shown in Fig. 2, C being a ball and socket to incline the jet. X. X.

Syracuse, N. Y.

The Influence of Color on Vegetation.

Messrs. Editors:—It is a well-known fact, that if growing plants are excluded from light, though not from air and moisture, they will become nearly or quite colorless, or of a pale yellow hue; and on the other hand, it is equally true that the foliage of nearly all healthy plants and trees, growing in the sun-light, are of one universal color, viz., green, with its various shades. Now as there are in white light but three primitive colors (red, yellow, and blue), and two of them (yellow and blue) are reflected from the surface of the leaf, forming green, it would seem that the color which is essentially a benefit to plants is that which they absorb; or red. Red and green, as well as orange and blue, yellow and violet, form white. This, I think, is a subject on which some interesting experiments might be made by any who has the necessary time and facilities. Make, say, seven small square sashes in the sides of which panes of glass may be inserted, each of one of the following colors, red, orange, yellow, green, blue, violet, and one of common glass; these with covers of the same (but no bottoms) may be placed over beds of plants, forming miniature hot-houses, and the result of the experiment watched. Perhaps young peas would be best to experiment on.

Theoretically, red would be nearest to, purple or orange next, and green farthest in effect from the natural growth.

One other substance—blood—is always of the same color. It seems that vegetable life needs red, and animal life green light, in the same manner that the former needs carbon, and the latter oxygen; in both cases, each giving of that which the other requires. The natural abode of man and other land animals, the forests, and even the sea, is of a greenish hue. As plants through the night are said to reverse the process of giving off oxygen and absorbing carbon, it may be that the red light of day prepares the surface of the leaf for the reception of carbon or the generation of oxygen, thus becoming an active agent in the production of vegetable growth. I should be pleased to have the opinion of the Scientific American on this, which I think is a subject deserving of more attention than it has received. Spectrum.

Havana, N. Y.

[We can hardly agree with our correspondent that red is the color essentially beneficial to plants. Timbs, in his "Curiosities of Science," says that experiments on hyacinths grown under the influence of various lights, proved that the yellow ray diminishes the growth of the rootlets and the absorption of water, and the red ray hinders the proper development of the plant. The blue rays retard germination at first, but accelerate the growth of the plant afterward; the act of germination being attended with absorption of oxygen, but the process of development, on the contrary, being attended with the extrication of this gas.

The experiments recommended by our correspondent are inexpensive, and easily made.—Eds.

Imperium in Imperio.

Messrs. Editors:—"A house divided against itself cannot stand." If this is true it seems that our industrial fabric is liable to overthrow. We see that, in spite of the basis of our government, as shadowed in the Declaration of Independence, in which it is stated that all men have an innate right to the pursuit of happiness, we are prevented from that pursuit by the interference of the members of combinations, who seem to suppose that the pursuit should be undertaken in only the paths they themselves have marked out. I believe I have a perfect right, in this country, to pursue happiness, *i. e.*, to do my own business, in my own way, without interference from any man, or set of men, if I do not infringe upon the rights of others. Believing thus, I have so acted. Conducting a business which necessitates the employment of workmen, I have employed men and kept them in work at fair wages, without caring to inquire whether they belonged to some trades union or not.

But a "change came o'er the spirit of my dream." My men, who had perfectly satisfied my demands, and always done their work well, one by one left me without any satisfactory reason. I found great difficulty in filling their places, and at length my eyes were opened by the receipt of several threatening anonymous letters, containing the information, that if I wanted workmen I must take members of the trades union at a fixed price per day, without regard to the qualifications of the workmen, or it would be "the worse for me." Paying no regard to these threats, and determined to do my business in my own way, without permitting outside and unwarrantable interference, I again attempted to employ hands to work at my business. I found my steps dogged and my efforts hindered and forestalled by members or agents of this trades union, even my personal safety being threatened in the streets.

Now, if we have a government in a government, an authority beyond the general law which shall compel men to obey its behests rather than depend upon the protection believed to be afforded to all good and peaceable citizens by the law, it is time it should be known, and a remedy applied. I hold and acknowledge no allegiance to any government but that of the state and nation in which I reside, and repudiate all attempts of bogus authorities, in the shape of trades unions, to regulate my business or the terms I make with my workmen. I want merely the common liberty of doing my business in my own way, and paying out my money as best for my interest and for the good of my workmen, both of which, I think, I can manage for myself and them, better than any association can manage for me. My business concerns myself and those who work for me—nobody else—and I shall not submit, in this land of personal freedom, to any dictation from unauthorized outsiders as to the method of managing my business.

I think it is time that something should be said by influential papers, as the Scientific American, in regard to this subject. This assumption of power and interference with private, personal rights by irresponsible and self-constituted arbiters of questions between employer and employed, has assumed such proportions in its interference and dictation between employing capital and employed labor, that it has become a question whether an individual has a right to the employment of skill, or even the use of his own hands without the consent of combinations whose practices are unquestionably illegal.

These unions and associations assume too much when they insist on dictating, not only the amount of wages to the employé, *but the person to whom the employer may give work.* The employer is not only the best judge of the qualifications of his workmen, but he is also the best judge of the amount each earns, and also of the advantages of one workman over another. As to his ability to know his own business—that is, his profit and loss—I presume, on this point, there can be no question. Crispinus.

New York city.

Modern Naval Warfare.

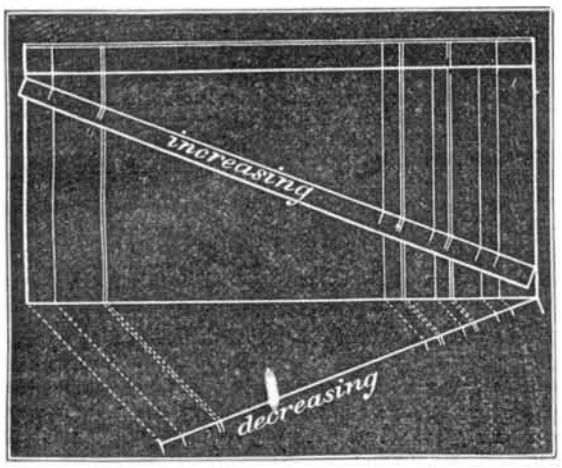
Messrs. Editors:—Mr. Holley, of Harrisburgh, Pa., might have given one more important invention to the credit of one of the Stevens family, namely, the Armstrong time and percussion fuze; the fuze being ignited by the liberation of a plunger held in position by a wire or its equivalent on the shock of concussion by explosion of discharge, when the plunger acted on a fulminate attached to the time fuze. This invention forms the basis of the Armstrong fuze and of all the time and percussion fuzes used during the late war, except a few used on the "Splingard" principle. Nearly two years ago I discovered at Fort Monroe, among the papers of Mr. Couch, master carpenter, a detailed drawing in sections of this fuze and which bore the names of two witnesses and date 1831. A copy of the original is in my possession. I afterward found in the Washington Navy-yard Museum, a perfect brass fuze of the same make, and the officer informed me that it was left there many years ago by one of the Stevens family. I called the attention of the army ordnance department to the fact when I made the discovery. No records of

the experiments with it could be found, but Mr. Couch was present when the experiments were made. It is strange that the navy department should so far neglect the interests of American inventors. The Armstrong fuze is, doubtless, more perfect in construction, but the principle is the same in both. Sir William Armstrong was handsomely paid by the British government for this invention. THOMAS TAYLOR.

New York, June 29, 1868.

Reducing and Expanding Lines.

MESSRS. EDITORS:—I send herewith a simple mode of changing the scale of any pattern of ruling. You will see that it provides both for increasing and decreasing the scale while preserving the proportions. I cannot think that a



thing so simple could have escaped the notice of professional men, yet I have never met one person who knew it. Perhaps if given in your excellent paper it may interest some of your readers. J. S. B.

Springfield, Ill.

[This method of reducing or enlarging lines we had supposed was too well known to require a published example, but we find frequently that many items of useful knowledge, long in use, are new to our correspondents, and at the risk of being considered behind the age we reproduce them as a means of instruction.

In the diagram the parallelogram may be considered a sheet of paper ruled. If it is desired to rule another but wider sheet, preserving the same relative proportions, it may be done by placing a slip diagonally across the sheet and marking on it the points where its edge intersects the ruled lines, then placing it squarely across the wider sheet, and ruling from the points as marked. For instance, if the original sheet is six inches across and the proposed sheet nine inches across, cut a strip nine inches long and place it on the six-inch sheet at such an angle that its ends sball agree with the edges of the sheet, then make the marks and transfer to the nine inch sheet. The contraction is done in reverse order, as shown by the diagram. It is evident that this plan is applicable to many uses. Draftsmen and others who use pen and pencil know its value.—EDS.

Adjustable Gears--Gears Without "Backlash."

MESSRS. EDITORS:—In Vol. XVIII., No. 15, page 228, there is a call for the invention of a gear which shall have no "backlash." I have been experimenting since that time, and think I have overcome this objection. It is evident that whatever be the form of the tooth, there will be "backlash" after the gears have become worn. I have resorted to a double arrangement to accomplish my purpose. Fig. 1 represents a section of this gear; A represents the gear proper and B a ring fitted to A and secured to it by the bolts. C, which pass through slotted holes. The proportionate width of the face of the gear and the face of the ring may vary with the amount of work to be done by each. Fig 2 is a side view of a section of the gears. The letters are applied to the

Fig. 1

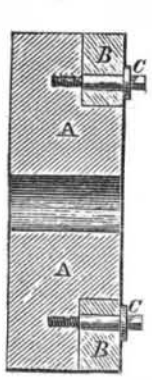
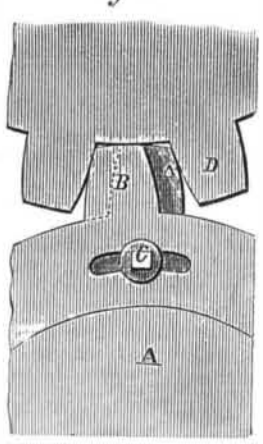


Fig. 2



same parts as in Fig. 1. The ring, B, with teeth on it the same as the teeth on A. being adjustable, can be moved about the center of A, sufficiently to make the teeth on A touch one side of the space between two teeth on a gear with which it meshes, while the teeth on B touch the opposite side of the same space. Only half the gears of a train need be of this kind. D is an ordinary gear, the teeth of which mesh with those of A. J. M. M.

[Objections will be raised to this method of overcoming the play or backlash of gearing because of its cost and its difficulty of adjustment We give, however, a diagram of our correspondent's plan, as in some circumstances the device may be found available and perhaps efficient. We have lately seen a gear which we consider superior on account of its cheapness, and fully as efficient. It is simply a double or treble gear, the teeth of which interpose with the spaces, so that when one relaxes its hold the others engage and keep up a thorough and intimate connection. The wear, alluded to by our correspondent, being divided among two or three sets of teeth, is very little in the aggregate, and the action of the teeth is very smooth and even.—EDS.

Eyeless Axes.

MESSRS. EDITORS: Reading an article, in your paper of the 1st, on the manufacture of edged tools in the United States, remind ed me of a story which may interest some of your readers. My authority for its truth is a member of the Chicago Board of Trade, who stated that he had *seen* several of the "tools" which were the heroes of his tale, that runs as follows:—

"When the great Eastern Rail Road from Michigan to Detroit was being built, the manager of the work, having a just sense of the superiority of the design of American axes over the English, caused a wooden model of one of Collins, best to be sent to Birmingham with an order for several thousand to be made for the use of the workmen who had to "blaze the way" through the immense forests of Upper Canada. Unfortunately he neglected to put on eye in his model, and in due time, received an exact duplicate of the same in the shape of a car load or so of highly finished and well tempered axes with *no hole for a handle.*

My informant stated that he had seen a quantity of eyeless axes lying in a warehouse opposite Detroit. C. B.

Nerves Uniting.

MESSRS. EDITORS:—In looking over some back numbers of your valuable paper I find, page 323, Vol. XVIII., that Mr. Eades (a dentist in Ohio who mentions a few intersting cases of teeth being extracted and afterward replaced) makes the following remark: "What is singular about it is that the nerve, after having been broken, should again unite. I do not see how this could be possible."

Permit me to remark that the *vis medicatrix naturæ* acts on nerves and brain matter as well as on muscle, bone, and skin, and that it is a well known fact in surgery that a nerve divided, either intentionally or by accident, will reunite as well as any other structure. The operation of dividing the facial nerve for the cure of neuralgia or tic douloureux has often failed to accomplish the cure intended, for this very reason; and some surgeons have even removed a piece of the nerve of about an inch in length, in order to prevent its reuniting, and the consequent return of the pain. Dr. Willard Parker, of this city, even testifies to a case where the nerve reunited in spite of the removal of a portion of it, and even of that part of the jaw bone through which the channel of the nerve passed. P. H. VANDER WEYDE, M. D.

New York city.

BLASTING WITH NITRO GLYCERIN.---COMPARISON OF THIS SUBSTANCE WITH GUN COTTON AND GUNPOWDER.

From a paper read a short time ago by Edward P. North, C. E., before the American Society of Civil Engineers, of New York city, we make the following extracts on the properties and uses of nitro glycerin. It appears from a statement in another column, that Mr. Nobel, the inventor of the substance, has not been able to control it within safe limits, as his own works were recently blown up:

I have been led to introduce to your notice the subject of this paper (nitro glycerin, or Nobel's blasting oil), because its application to blasting is comparatively new, and, consequently not generally known. As over three-fourths of a tun has been used on the New Canaan Railroad, of which I am now in charge, I may, perhaps, be able to convey some ideas of information and interest. I have, however, to regret that no accurate accounts of the comparative cost of quarrying with powder and nitro glycerin have been kept on this road, and that I can only give impressions as to the cost. It may be as well here to give a little sketch of nitro glycerin, and to compare it with powder and gun cotton.

Gunpowder is composed of a variable quantity of nitrate of potassa, sulphur, and carbon (charcoal), the nitrate of potassa being replaced in cheap powder by nitrate of soda.

Gun-cotton was discovered by Prof. Schonbein, about 1846, and its manufacture was almost immediately commenced, but never with financial success until lately.

Nitro glycerin was discovered in 1846, by Sobrero, but nothing was done with it until 1863, when Alfred Nobel patented its application to blasting. Gun cotton and nitro glycerin are made, the one from cotton and the other from glycerin, treated with nitric and sulphuric acid, the action of the sulphuric acid being, in each case, to intensify the action of the nitric. In the case of gun cotton, cotton which has a formula of C_{12}, H_{10}, O_{10}, is dipped into a mixture of three parts of sulphuric acid and one of nitric acid, by weight. Some of the oxygen in nitric acid goes to the hydrogen, forming water, and the formula stands C_{12}, H_7, 3 (NO_4), $O_{10}+6HO$, three parts of the hydrogen in the cotton being replaced by three parts of nitrous acid. On its explosion, it is all resolved into gases, namely:

		By volume.	By weight.
Carbonic oxide	CO	28.95	29.97
" acid	CO^2	20.82	33.86
Light carbureted hydrogen	C^2, H^4	7.24	4.28
Hydrogen	H	3 16	0.24
Nitrogen	N	12 67	13.16
Carbon	C	1.82	1.62
Steam	HO	25.34	16.87
		100.00	100.00

Leaving no residue. According to Von Lenk, in blasting, one pound of gun cotton is equal to 6,274 pounds of powder. According to a commission appointed by the French government, the explosive power of gun cotton depends, in a measure, on the degree of compression, and, in the mean, is about three times that of gunpowder. When uncompressed, it will burn more freely than gunpowder but by compression its rate of burning can be bought below that of gunpowder. Gun cotton, according to Prof. Abel, when well made, can be kept for a long time without undergoing change, and can be transported as safely as powder; but when impure and acid, a gradual decomposition takes place, the result of which is an explosion.

Nitro glycerin is made by treating glycerin, which has the formula C_6, H_5, N_3, O_{18}, with nitric and sulphuric acids, as in the case of cotton, and the chemical reactions are nearly the same, it being in both a case of the substitution of nitrous acid for a part of the hydrogen. By explosion, according to an article in the London *Mechanics' Magazine*, September, 1865, one volume of oil is converted into 429 volumes of carbonic acid, 554 volumes of steam, 39 volumes of oxygen, and 236 volumes of nitrogen—1,298 volumes in all, for one volume of liquid oil, being thus theoretically, five times more effective than its bulk in gunpowder; but by the greater amount of heat generated by the explosion, and the consequent higher tension of the gases, it is really thirteen times more effective by bulk, and eight times by weight, than the same. The United States blasting oil company, in a pamphlet published by them, assert that nitro glycerin has thirteen times the strength of powder by volume, and ten times by weight. It is a lightish, yellow, oily liquid, with a specific gravity of 1.6, nearly insoluble in water, not volatile, taking fire at 360° Fah., and freezing at from 40° to 36° Fah. When impure and acid, it decomposes spontaneously, with an escape of gas and the formation of oxalic, C_4, O_6 2HO, and glyceric, C_6, H_6, O_8, acids. Under these circumstances it is liable to explode.

My attention was first called to the use of nitro glycerin by the fact that our contractor, Lawrence W. Myers, was losing money, on account of the extreme hardness of the rock in one cut, and its wetness in another. As I advised the use of nitro glocerin, I, of course, took a great deal of interest in its success, loading and firing a great many of the holes myself. I will give a sketch of the circumstances and results as they appeared. In one cut, which in its deepest part was about 12 feet, the rock was mostly feldspar and mica, in large crystals; but it was very wet, springs forcing themselves up through the bore holes, so that they could not be puddled. Here the fact that nitro glycerin was entirely unaffected by water rendered it particularly valuable. The mode of procedure was this: A single hole was put down to grade about the center of the cut, a foot or two further back from the face than the depth of the cutting, so as to have the line of least resistance a vertical one; from five to eight pounds of nitro glycerin were poured in. A tin cartridge about four inches long, and three fourths in diameter, filled with powder, into which a waterproof fuse was introduced, was put into the nitro glycerin, and the hole filled with water. These charges were very effective, in some instances loosening over 100 cubic yards, so that it could be readily barred out, while that immediately around the charge was burned to a soft white powder. The quarrymen said it had turned to lime. About 50 per cent. of the rock was usually so fine as to be readily thrown into carts without sledging or block holing, while that furthest from the charge was in masses of two or three cubic yards.

In the other cut, which for about 50 feet was 21 feet deep, and contained about 8,000 cubic yards, the rock was very hard feldspar and quartz, so that sometimes drills were used up faster than one to an inch. In this cut it was found better to have the line of least resistance a horizontal one. There was no grain to this rock, it not splitting or breaking more readily in one direction than another. This cut was worked from both ends, one foreman using small holes, and, of course, more of them, while the other sank his holes in the center, nearly to grade, and tried to throw out the cut at one shot. Though the plan of single holes was not always successful, still, on the side on which it was tried, there was an economy of about 10 per cent. in labor per yard moved, and a slight loss in the quantity of rock per month, which latter item I think due to the fact that too much was put before the single holes, as the rock in the face of the cut was sometimes in masses of 5 or 6 cubic yards, requiring block holing.

The effect of nitro glycerin differs from that of powder in consequence, I suppose, of its greater force and quickness of explosion, in that, that powder, when fired, when the line of least resistance is a vertical one (the bore also being vertical, and the rock homogeneous), will form a tolerably uniform crater, with the sides sloping according to the hardness of the rock. When the line of least resistance is a horizontal one, and not too long, the rock being solid, the blast will throw out what is before it, leaving the back uncracked, and no sign of action below the bottom of the hole.

Nitro glycerin, on the contrary, in the first case, will form a well, and if the rock is not too hard, the bottom diameter will be greater than the top. Nor, as far as I have seen, will the action ever be concentrated on the line of least resistance, but will extend back from the hole and downward to a greater or less distance, according to the hardness of the rock. I think that this action of nitro glycerin, in connection with the fact that its explosive force is uninfluenced by the presence of water, will tend to its being the only explosive agent used in all subaqueous operations; for with any depth of water, it will be unnecessary to drill holes, only to sink a flask of nitro glycerin on the rock and fire it.

In regard to the relative safety of gunpowder, gun cotton, and nitro glycerin, I think the last named is the safest