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Contents:

(Illustrated articles are marked with an asterisk.)

ILLINOIS AND ST. LOUIS BRIDGE COMPANY---REPORT OF CAPT. JAMES B. EADS, CHIEF ENGINEER.

The St. Louis bridge, and the great suspension bridge over East River, between New York and Brooklyn, are the two greatest engineering works of the kind now in progress in this country, if not in the world. Both are demonstrating the value of the caisson as an appliance for constructing heavy masonry under water. The former, however, is attended with peculiar difficulties, resulting from the great depth of the abutments, the successful overcoming of which will establish the fame of Capt. Eads as one of the most accomplished engineers of the age.

This gentleman has forwarded to us advance sheets of his report, dated October 1, 1870, from which we shall endeavor to present in the present brief review, and in future extracts, as full as our page space will permit, the more important facts and statements of interest.

The masonry of the west abutment has been carried up from the bed rock of the river to 31 feet above low water. It now contains 6,380 cubic yards of masonry. When completed it will be 115 feet high above the bed rock, and will contain 11,860 cubic yards.

Greater difficulties were encountered in the construction of this pier than in either of the others, owing to the fact that the river at this point had been made the receptacle of every kind of useless material, old sheet-iron, furnace grate-bars, fire-bricks, etc., and two wrecks of vessels had also been sunk on the site of the abutment. More particular mention of these will be found in an extract from the report printed in another column.

The caisson for the east pier was launched October 18, 1869, and on the 25th of October, the first stone was laid upon it. No accident occurred in sinking it, and it reached and rested upon the bed rock on the 28th February, 1870. The bed-rock under this pier is 128 feet below high-water mark. During low water, the depth of sand resting on the bed rock at the site of this pier is 80 feet, at high water it scours down somewhat.

During the sinking of the caisson, the walls at one time sprung a leak, so that the men had to be signaled up. This occurred during extraordinarily high water, and work was suspended till the water subsided.

When the pier had descended 66 feet a telegraphic instrument was placed in the air chamber, and wires led to the office of the Superintendent of construction, and also to the office of the Chief Engineer. The moral effect of the knowledge that means of communicating with the upper world was constantly at hand, is said to have been very salutary on the workmen in the air chamber. The greatest pressure marked by the gages was fifty-two pounds.

Particular attention has been paid to the effect of this great pressure upon the health of the workmen. Capt. Eads' observations on this point are so valuable that we shall publish them in full in a future issue. Suffice it for the present to say that though twelve deaths occurred, one half the men constantly employed from the beginning to the end of the work escaped injury or inconvenience.

Our space is, however, entirely too limited to give anything like an adequate review of this able report. Our extracts from it, one of which will be found in another column, and others which will be found in future issues, will give a better idea of the magnitude of the work, and the ingenious and scientific methods adopted for its accomplishment than a column review could do.

The document is singularly free from any affectation of scientific display, and written in a plain, practical, and common-sense style from beginning to end. It is too full of facts for condensation, and we should be glad had we space to publish it in full, instead of confining ourselves to extracts.

EXPLOSIONS FROM HYDRAULIC PRESSURE.

The very limited compressibility of water and its consequent limited expansion when released from pressure, have led most people to believe that in making hydraulic tests, or in urging the cylinders of hydrostatic presses to their utmost power of endurance, no danger is to be apprehended from explosions. It is reasoned that the smallest rupture of the cylinders would so relieve the pressure that its force would instantaneously be reduced far below that of any expanding gas, and, therefore, that the bursting of a press cylinder could result in nothing more serious than the cost of repairing the damage to the machine.

That this fact does not secure immunity from accident is proved by a casualty which occurred during the testing of a cylinder in Manchester, England, resulting in the death of the man who was performing the test.

The cylinder, which was of steel, was subjected to a pressure of 7,000 lbs. per square inch. It burst under this pressure, fragments of the metal flying off with great force, wounding and killing the person above alluded to.

At the inquest Mr. Ommaney one of the firm owning the works in which the accident occurred, assigned the destructive velocity imparted to the fragments, to the elasticity of the steel.

Had the material of which the cylinder was composed been cast iron, the pieces of iron would have been forced out, and simply have dropped on to the floor, and the water would have flowed out in the usual way, as in a similar case which occurred at their works some time ago. He considered that the damage done was wholly due to the elasticity of the steel, which would be greatly expanded by the water, and when the bolts were displaced it would, as a natural consequence, contract so suddenly as to send the water out with a tremendous force. During the inquest a question was mooted as to whether there was any air left in the cylinder when it was filled, but all the witnesses agreed that such precautions had been taken as to make this absolutely impossible.

A writer in a Manchester paper discussing this accident maintains that the cylinder must have contained air, and such is our opinion. The elasticity of the cylinder does not, to our mind, afford a satisfactory explanation of the accident. The writer referred to argues that in testing such a cylinder (or any other apparatus) as that now under consideration, by means of water pressure, no danger would arise from the fastenings giving way or the metal of the cylinder being ruptured; while, on the other hand, should the vessel contain air, or partly water and air, then the danger is infinitely greater, since the confined air in virtue of its elastic force behaves just as steam of equal pressure would under similar circumstances. The public have read enough of late about boiler explosions to realize the danger attending the use of steam of, say, 50lb. to 100lb., when generated in vessels not sufficiently strong to withstand such a pressure, and yet few can believe that in the case before us a similar force, but exceeding 7,000lb. per square inch, was applied without sufficient precautions being taken to prevent accident. The air in the cylinder should have been completely expelled or displaced by the water before the pressure was applied. Had this been done there would have been no explosion, though the bolts should be too weak to stand the heavy strain upon them. The ram was "hurled a distance of 10 or 12 yards, while the cylinder recoiled about 7ft." Now this is all that any practical man requires to know in order to explain the cause of the accident; and yet, strange to say, the inquest passed without a single ray of light being thrown on the matter. The danger of allowing air to remain in the cylinder during a test has been well recognized, yet it seems that in this case it was overlooked, though the firm in whose works the accident occurred is composed of engineers of established reputation.

The accuracy of the gage used on the occasion is also questioned, and there is little doubt that the gages employed in such tests are often so inaccurate as to be unreliable in their indications of high pressures.

ARTESIAN WELLS.

Some of our readers will remember the article of Professor David Christy, published on page 54, Vol. XVI., SCIENTIFIC AMERICAN, on the subject of artesian wells. His investigations of large areas over the West and South, led him to discredit the common theory, that wells of this character can be obtained anywhere by boring deep enough in the earth's crust. His generalizations were controverted in our columns by several writers.

In addition to the facts then presented, Professor Christy now calls our attention to the late results of the attempts in St. Louis, Mo., to obtain a supply of water for the Insane Asylum at that city. The boring extended to a depth of 3,843½ feet without success. No water flows from it at the surface. The attempt has been a failure, and it has been abandoned. Thus the views of Prof. Christy, step by step, are being sustained. A year previous to the work being discontinued upon the boring at the State House, Columbus, Ohio, he predicted its failure in a lengthened essay. The failure of that enterprise proved the soundness of his deductions made from a knowledge of the geology of the surrounding country. The failure at St. Louis now confirms his views. The boring at Columbus was discontinued at the depth of 2,774½ feet.

The Professor calls our attention to this subject, on account of the views of Mr. Greeley presented at the monthly meeting of the New York Historical Society, a few evenings since, in an address relating to "The American Desert," occupying the country between the base of the Rocky Mountains and the Missouri River. This territory, he said, embraced an area of 400,000 square miles; and that "all this tract needed to make it one of the most productive portions of the continent, was water, which, in his opinion, could be readily furnished by artesian wells and other modern methods of irrigation."

Before emigration sets in to that section of country, it will be necessary to test the question whether a subterranean supply of water exists in it, which will rise to the surface. The experiment of the Government exploring party, a few years since, in boring for water, proved a failure, though conducted under the direction of a geologist.

SCIENTIFIC ADMINISTRATION.

The great want in the conduct of the affairs of our Government is scientific administration.

The number of men who have been appointed to office in the United States at any time during the last thirty years on account of any fitness for the positions is lamentably small. The question of fitness is discarded at once, and political considerations are made to outweigh knowledge. So common has it become to appoint men notoriously ignorant of the first principles of government or of political economy, that an education is looked upon as a defect in a man's training for political promotion and the number of persons who think it worth while to seek a liberal education is actually less at the present time than it was thirty years ago, although the population has vastly increased. It is in view of this startling statement of facts that many of our most enlightened citizens have formed a social science association for the discussion of the best way of remedying the evil. They call loudly for a reform in the civil service, and demand that appointments shall be made after competitive examinations and on grounds of fitness, rather than of political affinities.

It will probably require years to break up the present system, but that it ought to be destroyed, no man of intelligence will hesitate to affirm. But it is not alone in the administration of the affairs of the Government that a reform is needed. We could point out quite as urgent a necessity for a radical change in the conduct of private business, as can be found in the more conspicuous mistakes of office-holders. There are many large manufacturing establishments where scientific knowledge is sadly wanting. When we see "Positively no admittance" over the door, we conclude that somebody is afraid to have his ignorance exposed. Wise men know that the chances are altogether in favor of the workmen in every establishment gaining quite as much knowledge from casual visitors as they can themselves impart. We have heard a scientific friend relate how he was denied admission to an establishment in this city where the success of the works depended upon accurate knowledge, on the plea that the processes employed were secret. Subsequent inquiry revealed the fact that no one of any scientific knowledge was employed on the premises, and the fear of having this omission divulged to the stockholders was the occasion of the "No admittance."

Professor Liebig tells a story about a chemical factory he visited in Scotland. The proprietor politely showed the eminent chemist through an establishment for making Prussian blue. The noise of the machinery was so great as to preclude conversation, and the iron scrapers in a revolving mill rubbed so hard against the sides of the hopper as to wear out the shafting in a few months. After the party had returned to the open air, Liebig inquired why it was that the friction was allowed to destroy the scrapers.

"That is precisely the secret of my success," said the proprietor; "I find the more noise the machine makes, the finer is the quality of my product."

The manufacturer actually introduced iron into the prussiate of potash at the expense of his machinery, and he was not a little astonished when Liebig advised him to throw in the iron in the form of scraps and thus accomplish the same results.

This is a fair illustration of the way many capitalists have of avoiding the expense of employing scientific experts—they prefer to grind up their own machinery to asking a few questions for which they will be compelled to pay.

It is impossible to get on in the government, in the shop, in the factory, in the camp, or on the farm without scientific administration. No one who reads aright the lessons of modern times can deny this fact. The whole world is reading this lesson in the conduct of the affairs of Prussia, and in the great success of that nation. Fifty years ago the German nation was overrun by foreign troops, their villages were burned, their crops destroyed, their cities laid under heavy contributions. They were helpless and divided in council, and wholly unprepared for the shock. As soon as the notes of war ceased and the smoke had cleared from the political horizon, the leading statesman of the day began to inquire into the cause of the humiliating condition of affairs. The great minister, Von Stein, the Bismark of those days, was not slow to detect the utter want of scientific administration in all of the affairs of State as well as in the management of trades and manufactures. His remedy was thorough and complete—his reforms laid the foundation of the future grandeur of the German nation. Under his direction the public schools were re-

modeled and new universities founded. Men were prepared for every department by previous study and careful training. There were schools for forestry, schools for intercommunication, schools for diplomacy, for trades, for mines, for teachers, for soldiers, for professions, for everything that modern civilization required. The highest places in the gift of the Government were open to competition to the lowest citizen, and any man of sufficient talent could aspire to become the rector of the university or the minister of state, and in many instances the highest places were filled with men of the humblest origin.

The first fruits of the seeds sown by Von Stein were a crop of men fully competent to fill every position of responsibility in the nation, and year after year thousands of able men have been at work raising the standard of knowledge and proficiency in every department until we come down to modern times and find a nation thoroughly drilled on every side, with the best scholers, the best soldiers, the best mechanics, the best citizens, the best officers of civil and military affairs; in fact, a nation maintaining a thorough system of scientific administration down to the most minute detail of public and private affairs.

Those who are intimately acquainted with the industries of Germany are aware that such establishments as the iron founderies of Krupp, the salts works of Grueneberg, the ultramarine factories of Nuremberg, and the great woolen and cotton mills scattered over the land, are conducted with the same precision of scientific administration as has been so conspicuous in everything relating to the Prussian armies. In this we have the secrets of success, and a lesson for our careful study and imitation. Scientific administration is what we need in public and private affairs, and we would do well to study the signs of the times and profit by its lesson.

THE GREAT BRITISH PROBLEM.

How to diffuse intelligence over a thousand leagues of ocean is the difficult problem which Hazel has to grapple with in the story of "Foul Play." But this problem was actually solved by the reverend jack-at-all-trades, and hence was certainly not so profound as the one which has so long perplexed the entire English nation, and which may be put as follows: "How to diffuse intelligence from the inside of an English railway coach to the guard at the end of the train."

The cord and bell with which every American is familiar would not answer the purpose of frisky John Bull, who could not refrain from pulling it every now and then, and the method of locking passengers up by themselves renders the execution of such a feeble joke peculiarly easy to young and mischievous Britons.

Many and diverse plans have been suggested by which the removal of the difficulties attending such communication has been sought, but it is a harder knot to untie than communication between England and France across the Straits of Dover, and still remains, like the perpetual motion, something which attracts the minds of inventors only to disappoint their hopes.

The American system of admitting a considerable number of passengers to a single car does not find favor in the eyes of Englishmen. The thing is too democratic, too leveling, to suit their taste. And though it would put an end to the practical jokes of bell pulling and cushion cutting, which seem the idiosyncrasy of youthful and sportive "Bulls," it is, for the reasons stated, a thing not to be thought of.

The peculiar features of the English passenger system have recently been brought out in a strong light by a fight which occurred in a first-class railway carriage between Carlisle and Penrith; one Thomas Bell, a calico printer, and James Quirey, a linen manufacturer, being the combatants. The *Electric Telegraph and Railway Review* thus describes the "mill" and its origin:

"Mr. Bell and Mr. Quirey were the sole occupants of a compartment in a first-class carriage. Immediately after the train left the Carlisle station on its southward journey it seems that Mr. Bell accused Mr. Quirey of having stolen his ticket. This the latter protested he had not done, but notwithstanding all the protestations of innocence, Mr. Bell, in an excited manner, rushed at his fellow-traveler, seized him by the throat with one hand, and, with the thumb and finger of the other hand thrust up his nostrils, dragged him violently backwards and forwards in the carriage until Mr. Quirey's face was sadly cut and bruised. In the course of the encounter Mr. Quirey's collar was torn from his neck, and thrown, saturated with blood, on the carpet, while the windows of the compartment were completely smashed. Passengers in the adjoining compartments heard the cries for help, but, as it unfortunately happened, the passengers' signal was not workable, and Mr. Quirey had to struggle against the violent assaults of his excited adversary, who threatened to kill him, for nearly half an hour, the time occupied in traveling between Carlisle and Penrith, a distance of eighteen miles. On pulling up at Penrith station Mr. Quirey alighted, bruised, bleeding, and much exhausted. Mr. Bell still charged his fellow traveler with having committed a robbery, and on both men being searched the ticket was found on the person of Bell himself. Mr. Quirey then preferred a charge of assault against his assailant, who was taken by the police and locked up in Penrith police station. About six o'clock in the morning a policeman who was on duty at the station looked into the prisoner's cell and found him hanging over the side of his bed with a deep gash in his throat, which had been inflicted with a penknife left in his possession. He was still sensible, but in a very exhausted state through loss of blood.

"On being interrogated by Superintendent Fowler the prisoner replied, 'I would rather suffer death in this way than that I should have been covered with such disgrace.' A medical man speedily dressed the wound, which was a dangerous one. On being brought before the magistrates the prisoner was sadly cast down. He was charged with the assault and also with committing suicide. He had apologized to Mr. Quirey, and offered to pay any amount to himself or to any infirmary if he would withdraw from the case; but this Mr. Quirey declined to do, remarking that it was his duty to the public to prosecute, and the prisoner was committed for trial on both charges, bail being accepted for his appearance."

Truly it would seem that the pugnacity of John Bull is scarcely inferior to his sense of humor.

The journal from which we gather the above statement suggests the electric telegraph as a means for conveying intelligence to the conductor. This might be better than an atmospheric railway, but have our English cousins ever thought of a flying machine for this purpose? If not, we throw out the hint as one that may lead to something.

THE FOREMANIZING PROCESS FOR PRESERVING TIMBER, THE VICTIMS OF ITS POISONOUS EFFECTS, AND THE SUITS AT LAW WHICH HAVE BEEN INSTITUTED TO RECOVER DAMAGES.

The use of the Foremanizing process by the St. Louis, Vandalia, Terre Haute, and Indianapolis Railroad in the preparation of timber for the erection of their depot at St. Louis, the poisoning of a large number of workmen employed on the work, and the death of four or five of the victims, are facts which have been already laid before our readers.

The process which has resulted in such a lamentable disaster is the invention of Mr. B. S. Foreman, of Morrison, Ill. The compound used to preserve the timber from decay consists of the following substances, in the proportions named: one ounce of corrosive sublimate, six ounces of arsenic, and sixteen ounces of common salt.

The directions given for the preparation of the timber are given in a pamphlet kindly sent us by a St. Louis correspondent, the pamphlet being published by B. S. Foreman & Son, of Morrison, Ill. The formula is as follows: "Take the lumber while still green, and pile one layer on the ground, packing close; over this layer sprinkle evenly the dry powder, in the ratio of twenty pounds of powder to every thousand feet of lumber. Lay another layer in the same manner, sprinkle powder in the same proportion, and continue the operation until the amount desired is prepared. Allow this to remain close packed until fermentation has taken place, when the lumber will be fully Foremanized, and from thenceforth free from shrinkage and practically seasoned. N. B.—To induce fermentation of timber a temperature of 45° F. is indispensable."

The effects of working timber prepared in this way were precisely what any one well versed in the nature of the poisonous materials employed would have expected. The men were attacked with blisters and sores. *Œdema arsenicalis* and symptoms imperfectly described as resembling those of venereal disease (the latter undoubtedly the result of exposure by sitting upon the poisoned timber) mingled with the well-known symptoms of poisoning by corrosive sublimate were among the effects of the poisoning.

A *post mortem* examination of one of the diseased workmen revealed the following facts: The stomach was found to be fearfully ulcerated, while the lungs and liver were nearly destroyed by abcesses, the right lung being one mass of corruption. The testimony showed that last spring the deceased had been engaged at work on the Vandalia railroad depot in East St. Louis, the timbers of which had been sprinkled with a white poisonous powder to render them non-combustible, the process being known as Foremanizing; that deceased inhaled this powder, and shortly broke out with ulcerous sores and blisters; experienced great difficulty in breathing; was taken with a chronic and painful diarrhea, and that he gradually became weak and emaciated, and died as before stated. The examining physicians testified that the condition of Smith's body pointed unmistakably to arsenic as the cause of death. The jury then unanimously rendered a verdict that Smith "came to his death by inhaling a poisonous composition used in building the freight depot of the Vandalia Railroad Company, at East St. Louis, Illinois, he being employed by the company as a laborer." Many of the surviving workmen are said to be permanently injured.

Eleven suits have been brought against the railroad company, laying damages at $25,000 each. The declaration of the parties asserts that the railroad company was bound to furnish them good timber to work with, but that instead they were compelled to work upon timber which had been sprinkled with a poisonous powder. This substance they inhaled, absorbed, and otherwise took into their systems, thereby being injured in body to the amount for which the suits are brought.

The case is a somewhat peculiar one, and as it could only have originated either in willful rashness or in culpable ignorance of the usual effects of well-known poisonous substances, we think the plaintiffs are fully entitled to recover the damages for which they sue.

SCIENTIFIC INTELLIGENCE.

IRON BLUE WITHOUT CYANIDES.

A beautiful blue color can be prepared from iron without the aid of ferro-cyanide of potassium. Make a saturated solution of sulphate of iron (green vitriol) in water; convert $\frac{4}{7}$ of this into the sulphate of the peroxide of iron by means of sulphuric and nitric acids, and then add the remaining $\frac{3}{7}$ to the original liquid. Concentrated sulphuric acid, cautiously poured in, to prevent too great heat, will occasion the formation of a blue precipitate, which is, however, soluble in water, but if it be separated from the liquid and rubbed with phosphate of soda, a beautiful blue phosphate of iron is obtained which will resist the action of water, and can be used as a paint.

The mixed hydrates of oxide and peroxide of iron are deprived of water, and prevented from forming higher oxides, by the acids and phosphate. The reaction works well in a small way, and it remains to be seen how far it is capable of application on a large scale. If we can prepare a substitute for Prussian blue without the use of poisonous cyanides it will be a real benefit to calico printers and color manufacturers.

CHLORATE OF BARYTA.

For experiments on explosive mixtures and on chloric acid, a very convenient salt is the chlorate of baryta. This can now be obtained, according to Brandau, in a very simple manner. Commercial crystallized sulphate of alumina, sulphuric acid, and chromate of potash in the ratio of one molecule of each of the two former to two of the latter, are cautiously mixed with water to the consistence of a thin paste, and warmed over a water bath, allowed to cool, and treated with alcohol in excess. Upon filtering and neutralizing with hydrate of baryta, precipitates of sulphate of baryta and hydrate of alumina are formed and barium chlorate remains in solution. The alcohol is distilled off, and on evaporation crystals of pure chlorate of barium are formed. Care must be taken not to pour sulphuric acid upon the chlorate of potash alone, but to use the mixture of acid with the aluminum salt. The chlorate of baryta has no uses at present in the arts, but chloric acid, on account of its powerfully oxidizing properties is capable of extensive application, and the new salt of baryta, above described, may be the means of affording it readily and economically.

NEW USE OF TUNGSTATE OF SODA.

Professor Sonnenschein, of Berlin, has found that when glue in thick solution is mixed with tungstate of soda, and hydrochloric acid is added, then is thrown down a compound of tungstic acid and glue, which, at from 86° to 104° F. is so elastic as to admit of being drawn out into very thin sheets. On cooling this mass becomes solid and brittle, but, on being heated, it becomes again soft and plastic.

This material has been employed as a substitute for albumen in fixing aniline colors in calico printing, and it has been tried in tanning, but produces very hard and stiff leather. As the tungstic acid renders fabrics incombustible, its use in combination with glue in calico printing would be a valuable feature. How far it is applicable in the manufacture of paper and as a substitute for albumen in photography, remains to be seen.

The tungstic glue may also have an application in the manufacture of billiard-balls, buttons, knife handles, and in general as a substitute for india-rubber. It is recommended as a lute and cement.

ADULTERATIONS OF COMMERCIAL ARTICLES.

Some calico of English manufacture was recently analyzed by a Swiss chemist and found to contain 25 per cent of the weight of the fiber of foreign substances, 5 per cent of which consisted of mineral matter. The calico was sold at a price below the value of the yarn it was made of.

A sample of starch intended for calico dressing was found to be adulterated with 16 per cent of gypsum. Some black silk in France was weighted with chemicals that proved to be spontaneously combustible, and nearly set fire to a warehouse in Paris. Paper is also notoriously loaded down with chalk, barytes, or clay, and to make the matter still more complicated, it is found that all of these articles are themselves adulterated, so that the microscope reveals adulterations of adulterations in commercial matters just as it does of parasites living on other parasites, down to the lowest order of living beings. Little fleas have other fleas to bite 'em, and so on *ad infinitum*.

Explosive Power of Nitro-Glycerin.

We condense from the *American Chemist* the following upon the above subject:

A measure containing one cubic foot will hold 796 ounces of blasting powder, and 997·1 ounces of water; or, in other words, the specific gravity of blasting powder, as it is used, is about 0·8. This, of course, takes in the interstices, which are filled with air, but as we do not use the powder in a solid lump, this is, for practical purposes, the specific gravity of blasting powder. Now the specific gravity of nitro-glycerin is 1·6. Therefore, bulk for bulk, if the explosive power were the same in a given mass, as prepared for blasting, the nitro-glycerin would have twice the power.

In reality the following are the volumes of gas generated by each respectively in explosion:

One volume of powder which is considered as most effective, produces:

Carbonic acid gas	221·4 vols.
Nitrogen	74·6 vols.
Therefore one volume becomes	296·0 vols.

Of another kind of powder, which explodes with the gases at a lower temperature, one volume produces:

Carbonic oxide	391 vols.
Nitrogen	66 vols.
One volume becomes	457 vols.

One volume of nitro-glycerin produces:

Carbonic acid gas	469 vols.
Water at 100° C.	554 vols.
Oxygen	39 vols.
Nitrogen	236 vols.
One volume becomes	1,298 vols.

These volumes are given at the temperature 0 deg. C.; at the temperature of explosion, they will be about five times greater, or about 10,607 times the original volume of the explosive, or about ten times as large a production of mixed gases for the nitro-glycerin as for the gunpowder which produces mixed gases in largest amount.

Still thirteen times is claimed by the advocates of nitro-glycerin. If this is so, the discrepancy between the temperature of the explosions must be greater than here assumed.