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Contents:

(Illustrated articles are marked with an asterisk.)

HOW LONG SHALL NITRO-GLYCERIN CONTINUE ITS WORK OF DESTRUCTION?—THE FAIRPORT EXPLOSION.

We have been taught from early infancy that human life is of all carthly things most sacred and valuable. The Scriptures tell us the greatest evidence of love a man can manifest is to give his life for that of his friend. Yet in these latter days we seem to have adopted a new gospel, by which the pecuniary interests of corporations and unscrupulous and avaricious men, are set higher in the scale of value than the lives of innocent, industrious people, and the happiness of families.

Since the first introduction as an explosive agent of that most terrible compound, nitro-glycerin, its history has been one of disaster and destruction. The calamities, of which it has been the cause, are too horrible to dwell upon, even in the recollection. It is our painful duty to now record still another, and we copy the following brief account of it from the Painesville (Ohio) *Telegraph*. The explosion took place at Fairport, Ohio, on Tuesday the 1st inst.

"At about 5 o'clock the people of Painesville were startled by a sudden concussion of the doors and windows, and jarring of buildings, as though some heavy body had been hurled against them, with a force almost sufficient to crush them in. This was followed by a dull heavy reverberation, similar, yet still unlike, the firing of heavy guns at a distance. Buildings were jarred, and trembled as though shaken by an earthquake. The reverberation and rolling sound as of distant thunder were perceptible at least from three to five minues after the first concussion was felt. An immense cloud of blood-red smoke was seen to arise in the direction of Fairport, and then to change its color to a lighter hue, and spread itself out in the heavens. This terrible phenomenon at once seemed to explain the cause of the great commotion. All at once understood that it was either the explosion of the nitro-glyccrin manufactory or their magazines. Teams were immediately brought into requisition, and a number of our citizens started for the scene. It would be impossible to describe the scene which the town presented. The whole place seemed at first a complete mass of ruins. The buildings were shattered, the doors blown off their hinges, the windows all smashed in, plastering off, crockery, lamps, and looking-glasses demolished, chimneys torn down, stoves overturned, and everything in the houses in utter chaos. But if the scene was terrible within, it was still more so without. The whole population nearly were in the street, wild and crazed. The crash had come so suddenly, and the concussion had been so great, that many of them for the time were perfectly insane. Some of the men were for a few moments attacking each other, and women were insanely struggling, while all were loudly weeping and wailing. Children were running wildly about, screaming in terror, as if seeking protection, while others were struggling and screaming in the arms of their mothers, who were rushing hither and thither, not knowing what to do or where to go.

"Both the magazines of the Glycerin Company, situated on the west side of the river, had exploded, and four men who were at work in or near them were blown to atoms. The immediate cause of the explosion is not and never will be known. It is supposed that Mr. Malone, one of the four men, was digging a pit for a new magazine, and that one of the men was engaged in putting glycerin into cans from the jars in the magazine ready for shipping, while the other two were in some way assisting, by carrying glycerin backward and forward between the magazines and the manufactory. The explosion of the two magazines, which were near each other, was simultaneous, so far as the people in the vicinity could judge, they hearing but a single report. The men were blown to atoms. So far as we have heard only one piece of flesh has been found, not larger than a man's hand, and a bone, apparently part of a rib.

"The effect upon the magazines was wonderful. Of the frame structures only a handful of splinters was anywhere to be seen. It seems as if the wood must have been consumed, or the pieces blown so far that no one has yet found them. The force of the explosion penetrated deep into the earth, heaving out immense quantities of sand, and below this huge masses of blue clay. The holes, which must have been blown out to the depth of fifty or sixty feet, soon filled with water up to the level of the lake. They are forty or fifty feet in diameter at the top, and seem like the craters of extinct volcanoes. Two or three sycamore trees, which stood near the magazines, were scathed and rent, limbs were wrenched off, and all covered with sand and blackened, as if swept by a fiery tornado.

"The explosion was felt even in Buffalo, a distance of 160 miles. Soon after it occurred, a dispatch was sent over the wires from that city to Cleveland, and other points on the lake shore, asking if they had been again visited by an earthquake.

In Painsville, the shock was very severe, especially in the south part of the town, where the clay or hard pan comes very near the surface. In one small house we have heard of, things were thrown from the shelves, and a bedstead moved near two feet. It is supposed that the explosion must have reached the clay or hard pan, some thirty feet below the magazine, with such force, that houses built on that strata, though some miles distant, were more affected than those on the sand much nearer."

In addition to the above particulars, we have received, through private sources, others, some of which show in a most startling manner the appalling force of nitro-glycerin.

We are told that a physician riding at a distance of not less than twelve miles from the scene of the disaster was stunned by the shock, and his horse brought to a stand-still. Upon looking at his watch he found that the concussion had stopped it.

Another man sick with typhoid fever, lying two miles from the magazine, was instantly killed by the shock.

There is something intensely awful in the contemplation of a force like this, which, held by a slender and feeble thread, will, when let loose, rend the air like an earthquake and scatter destruction for miles around.

Since the introduction of nitro-glycerin to this country we have more than once raised our voice in denunciation of it as a far too dangerous substance to be allowed to exist in larger quantities than a chemical professor would venture to exhibit to his class. Experience has shown that it may, and will explode under the most ordinary circumstances which attend its storage and transport, and that it cannot with safety be intrusted to the handling of such men as must use it, if used at all, for purposes of ordinary blasting. The damage done by it has far exceeded any good derived from its use, and it is time, and more than time, that its record of death should be terminated by stringent laws prohibiting its general use.

ROADS AND ROAD-MAKING.

Of primary importance to the civil as well as military power of any country are good public thoroughfares. Rapidity and cheapness in transportation are vital necessities to commercial prosperity, and in time of war the safety of a nation may depend upon the state of her roads. These facts have long been recognized, and hence the perfection of roads has been a problem to which engineers have in all ages assiduously applied themselves. The importance of even a slight advance in improvement has kept alive interest in this department of engineering, and century after century has elapsed without the perfect ideal being considered as yet reached.

That this is true is proved by a very brief review of the Patent Office records, in which patents for various compositions for road surfaces, and for methods of road-building, constitute every year a notable number of the patents applied for and issued.

Probably the most remarkable success ever yet achieved by any one system was that which attended and still attends the macadam road. Notwithstanding its expensive character, it to-day covers more surface in Europe than any other. In America, except in the vicinity of large towns, this road is not much employed, the comparative sparseness of the population and the small amount of travel in rural districts not warranting the cost of its construction and maintenance.

There are few circumstances under which this road is not admirably adapted to town and country thoroughfares. It has a smooth surface, after it has been a little used, and affords an admirable foothold for horses. It is expeditiously laid, and perhaps demands as little expense for care and maintenance as any other capable of equal endurance and service.

It is now fifty years or thereabouts since Macadam introduced this celebrated system, and it is quite doubtful whether the next fifty years will give the world anything better for all purposes. But, as we have already said, this system is not at the present, nor is it probable that it soon will be, available for the greater part of American thoroughfares.

Roads in this country must, from the nature of the case, be constructed of such materials as are available immediately along their lines, and must necessarily be more or less imperfect.

In this as in other countries the great enemy of roads is frost, and the only way to even partially prevent its ravages is to construct roads high enough to allow thorough drainage. The flat surfaces permitted on most roads in this country is their most radical defect. The result is rivers of mud in spring and autumn, and frozen ruts of indescribable ugliness and discomfort in winter until such time as the snow covers and fills them.

A few days' labor devoted to thorough ditching along the sides of roads and elevating the centers where they have settled below the proper grade would greatly mitigate the evils complained of. This is generally done, when done at all, by throwing back on the road the soil excavated from the ditches, a very erroneous method and almost a sheer waste of labor. Such soil is generally composed of comminuted and pulverized material washed off from the road, and will only temporarily pack. As soon as it becomes very dry in summer it grinds up into a dust heap, and is blown off by winds, and washed off again by rains.

All soil used to raise the level of roads should be new soil, not the washings of the roads, which latter should be carted away. Where roads are much traveled these washings are a valuable manure, and it would pay well to cart them into the lands lying along such roads, from which soil of inferior fertility might be taken to form the roadways.

Wherever practicable, a deep hard bed of stone or timber should be laid below the reach of frost, upon which the surface material should be distributed. Gravel stands unrivaled for road surfaces, but it is not available in many localities. Broken stone, however, is obtainable oftentimes where gravel cannot be got, and answers the purpose very well.

We have seen a road laid through a swamp made with a bed of rough logs, well sunk down, and covered with a mixture of blue clay and broken stone, which was excellent in all respects, having almost as good and permanent a surface as macadam.

It is usual to work country roads early in the summer, to repair the defects caused by spring upheavals. This done, they are generally left till the ensuing season, when the same operation is repeated. But a little labor late in the fall would pay well on most roads. This labor should be expended in securing proper drainage. All sluices should be opened if stopped, the roads raised where the summer wear and tear have depressed them, and their surfaces made smooth, so that the water may run off with the utmost facility. Neglect in these particulars is always dearly paid for in the miring of teams and wagons, and in wear and tear of both animals and vehicles.

THE MOTIVE POWER OF EXPANDING GASES.

The power of expanding gases to perform work has only been successfully applied in the use of steam or water-gas, and atmospheric air. In the use of these gases they are allowed to escape after having expended a portion of their heat in the performance of work, and escaping to carry with them a portion of the heat imparted to them. In condensing steam engines, a portion of this heat is recovered and sent back to the boiler in the feed water, but a considerable loss is nevertheless experienced.

The general belief has been that fluids capable of being changed into gases by the action of heat, are more applicable to motive purposes than permanent gases. And we have yet to be convinced that this belief is not scientifically correct. It is true that the heat expended in converting water into steam at 212° is, and cannot be otherwise than lost in working steam under ordinary atmospheric pressure, in non-condensing engines; but this loss is so far compensated for by the conveniences attending its use, as contrasted with that of permanent gases, that it still maintains, and seems likely to maintain its supremacy.

Notwithstanding this, numerous attempts have been made and are still making by able engineers, to substitute permanent gases for steam in the working of engines. For the most part, air is the material employed, and it is with this material that the greatest success has been acheived. It has been used both separately and in combination with steam. In the latter method, no very remarkable and permanent success has been reached, though some attempts in this direction have seemed to promise something.

With air used singly, there are now several engines, popularly known as "Caloric engines," which are efficient, safe, and economical within certain limits of power; but all attempts to develop great power with a single motor have failed up to the present time. With this brief review of the past and present history of invention in this field, we may proceed to notice an attempt recently made by Mr. A. W. Bickerton, F. C. S. associate of the Royal School of Mines, who, in a paper presented to the British Association recently, gave an account of his invention.

Without admitting that the claims for economy made by him are probable or even possible, we think the statement made in his paper will interest our readers, and, therefore, will close this article with an abstract from it, which gives the principal features of his invention.

Crude nitrogen gas is heated in a serpentine system of tubes until the pressure is double that of the air. It is then admitted into a cylinder in which it presses forward a piston, and is allowed to expand. Next it passes into an apparatus where it is cooled, and consequently diminished to half its bulk. The cooling is effected in a new arrangement, which is so constructed that the whole of the heat above that of the external air is transferred to an equivalent volume of air passing in an opposite direction. This heated air is then used as a blast for the fire, $\frac{1}{10}$ going to the hearth of the furnace through a tweer, and $\frac{4}{10}$ mixing with the products of combustion immediately above the fire, so as to complete any imperfect combustion, and also to modify the temperature of the whole mass, so that it may not be likely to injure the iron of the gas tubes, and the remaining $\frac{5}{10}$ being introduced into the system at a point further on. The construction of the system of tubes is such that, by the time the products of combustion reach the open air, they shall have parted with nearly all their heat, and transferred it to the nitrogen contained in the tubes, and hence a chimney draft cannot be used, and the blast has to be produced by a blowing engine. The nitrogen, after having been cooled to half the volume it occupied in the cylinder, is then compressed and forced into the system of tubes at the point furthest from the fire. If this forcing the gas back again into the system of heating tubes appears absurd, it must be remembered that the gas while leaving the heating tubes occupies twice the space it does when being forced back, hence it fills a cylinder of twice the area, and the force that may not be disposed of is equal to half the pressure exerted in the larger cylinder. But the other half of the power is not lost, it is simply conveyed back to the heating tube, and is used again. The losses that arise are those incidental to all engines, such as radiation, conduction, the enormous loss of heat that usually goes up the chimney, together with the still greater loss that is constantly being carried away by the condensed water is avoided—an amount in itself six times as great as that converted into work in the steam engine. The inventor expects his new heat engine to convert 60 per cent of the heat of combustion into work, a duty that is fully 500 per cent above that of well-constructed steam engines.

TIME AND DISTANCE.

At the very bottom of all exact science lies a just conception of time and distance. It may be said that no such thing as an exact science could possibly exist without the ability to accurately measure these relations. In the science of mechanics and its application to practical work, in the shop, and manufactory, they are both fundamental in importance. The terms, speed, velocity, rate, etc., all express the relations of time and distance, and the measure of power to perform work is a definite number of foot-pounds raised per minute.

The unit of work is one pound raised one foot without regard to the time employed in the elevation. The term work, then, does not include the idea of definite time, while the term power does.

This distinction is of primary importance to the correct conception of the laws of applied mechanics. Work is the overcoming of any resistance, whether the time occupied in its accomplishment be long or short. Mechanical power is that which can perform work or overcome resistance in definite time, whether the power be strength of men or horses, the fall of water, or the expansion of steam.

When we attempt, however, to conceive of time and distance we can set no limit to either; they expand to an illimitable extent. We are obliged to conceive of time only as the relation of the succession of events, and of distance as the relation of position. In the measurement of time, we adopt as the unit the interval between two events which succeed each other at uniform intervals. The oscillations of pendulums of uniform length, in the same position upon the surface of the earth are found by experiment, and may be mathematically demonstrated, to succeed each other with perfect uniformity of interval. The rotations of the earth upon its axis also practically succeed each other at uniform intervals. Thus we have both an artificial and a natural standard of time.

From natural standards of distance may be derived artificial ones, and standards of time—as the length of a pendulum oscillating seconds—may be made to correct standards of distance or length. From these two standards may be derived all other measures whatever they may be.

Few have anything like an appreciation of the vast importance of accurate measurement in the natural sciences. But such measurements are all based on time and distance. All weights are primarily derived from measurements of distance, and it follows that all estimation of magnitude, den sity, hardness, or any other physical property measured by pressure or weight may be referred back to measurement of distance.

It is therefore in and through the consideration of these relations that we gage all our sensations of external things. For size, intensity of color, and light, form, weight, and temperature, all are estimated, and conceived only through some application of these relations. Deprive the mind of any means whereby it may estimate or imagine the distance of a body from the eye, and it can form no conception of magnitude, and it is only by comparison of relative distances of parts from each other that it can conceive form. It is true that form also depends upon direction of outline, but direction is not apparent without extent or distance, and hence this consideration does not invalidate the foregoing proposition.

Even our knowledge—in so far as we have any—of the molecular constitution of masses is obtained in great part through the application of these relations. The definite weights in which chemical combination takes place is only an expression of definite bulks, or volumes, established by measure.

These relations are types of that in which all human knowledge consists. We perceive nothing and conceive nothing but relations, and the combination of relations of which the mind takes cognizance are to it the embodiment of all external things. The idea of relation, however, involves the existence of something to be related, and thus the idea of material existence is inferred; but as we cannot go beyond relations in mental operations, the existence of matter can never be made the subject of actual demonstration.

The existence of force is also inferred from change in the relation of distance, and is perhaps as just an inference as that of matter, though in our opinion not so essential to thought. Neither force nor matter can be estimated as entire entities, we can only conceive of them through relations of mass and movement, which are, as we have seen, only measured by the relations of time and distance.

In considering the ideas of matter and force we stand on the very border line which circumscribes thought, but even here, the moment we attempt to relinquish our ideas of time and distance we become lost in a maze from which we may return, but through which we find no pathway for the human intellect to transverse.

RESIGNATION OF COMMISSIONER FISHER.

The following letter will explain itself:

UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., Nov. 8, 1870.

SIR:—I ask permission to renew the tender of my resignation of the office of Commissioner of Patents, made October 24, and temporarily withdrawn at your suggestion. If there be no reason to the contrary I suggest that the resignation be accepted, to take effect at the close of Thursday, November 10th, inst. I have the honor to be, very respectfully, your obedient servant. SAMUEL S. FISHER.

To his Excellency, U. S. Grant, President United States.

Colonel Fisher has been an able, industrious, and conscientious public servant. The labors and reforms which he has introduced will be felt to advantage in the future administration of the Patent Office.

At the time of our going to press no appointment had been made to fill the vacancy. The names of Samuel A. Duncan, Assistant Commissioner of Patents, William Bakewell, patent lawyer, Pittsburgh, Judge Allison, Registrar of the Treasury, T. C. Theaker, Ex-Commissioner of Patents and patentee, Horace Greeley, President of the American Institute, Clinton Rosevelt, scientist and inventor of the panatechner, J. K. Fisher, steam carriages for common roads, Gideon Welles, Ex-Secretary of the Navy, Jonathan Dennis, Quaker and solicitor, E. P. Weston, the great pedestrian, and other well-known names have been mentioned; and that the interests of female inventors may not escape recognition we suggest the name of Elizabeth Cady Stanton.

ATTEMPT TO ABOLISH THE PATENT OFFICE.

A correspondent of the *Tribune* telegraphs from Washington that "a bill will be presented to and pressed on Congress for the abolition of the Patent Office Bureau. This office has, it is alleged, become too complicated to be beneficial and must either be abolished or have its jurisdiction materially changed."

A correspondent who has noticed this paragraph inquires "Whether if Congress should abolish the Patent Office it would cancel all unexpired patents."

We answer No. If the Patent Office should be abolished now or hereafter it could not affect patents issued before the act of abolishment went into effect. At present there is no likelihood that any such act can be got through.

A Successful Inventor.

Freeman Talbot, of Rockfield, Minn., writes: "I should have acknowledged the receipt of my patent before this were it not that I have been away from home for the last two weeks. During that time I have made more than three times what the patent cost me, and the future looks bright.

"I do not propose to take out more than forty patents more, and would here remind the eager aspirants for my patronage that the able, reliable, long-established, and world-renowned firm of Munn & Co., 37 Park Row, N. Y., are quite capable of doing all my business with the Patent Office to my entire satisfaction; and I am, from a sense of duty to my family and of gratitude to you, obliged to refuse the kind offers of those individuals and companies that have already offered their services."

A Veteran Inventor.

I. S. Clough, of this city, and who by the way is a true philosopher, writes to us as follows: "Promptness in business is one of the most prosperous traits for business men. I have to thank you again for your successful manner of application for a patent, you having taken out several for me since 1849—the last one on a complete ash-sifter, which I applied to you to procure for me on the 5th of October, and on the 13th I received official notice that the patent was allowed. This speaks well for the way the cases are managed at the Patent Office, where they always are much assisted if a finished model in all its parts, showing the benefit of the improvement, is sent with each application. This, with your manner of explaining the same, so truly written out and illustrated, makes all satisfactory and easily understood."

LETTERS FROM THE SOUTH.

COLUMBUS, Ga., Oct. 17, 1870.

Southwestern Georgia—Savannah—Atlantic and Gulf Railroad—Orange Fever—Macon—Columbus—Cotton Factories and Water Power—Railroads.

Southwestern Georgia, of which Columbus is the northern angle, is the great peculior cotton region of the State. The soil is mostly underlaid with rotten limestone. Just here commences the granite range. The land is fertile, but the people are poor, for they depend almost entirely on cotton as a crop, merely entertaining the foolish idea that corn will not grow on their lands. Albany is the center of this section and has its outlet through the Atlantic and Gulf Railroad to Savannah. This railroad traverses for the greater part of its length vast tracts of pine barrens, whence the markets of Savannah and the world are supplied with lumber. They claim to average about three million feet per month. It connects southward with Florida, whence, I am informed, quantities of canned pineapples are brought. It seems that this fruit is brought to Cedar Keys, there put up, and thence sent to Savannah by rail. In the hight of the season as much as two car loads a day are shipped. The saving of sugar by being enabled to use riper fruit is said to be very great. Another article of commerce sent over this road to Savannah and thence to Europe, is black (or sea island) cotton seed for oil making. Of this 500 tuns were sent in six months of 1870. This railroad also connects, via the Macon and Brunswick Railroad, with the to be great city of Brunswick. For fifteen or twenty years the fine harbor has remained almost unimproved except by occasional efforts to bring it into notice. Now it has passed into the hands of Northern capitalists, and if they do not make it in reality what it has been so long in name—a city—it will not be through lack of enterprise and good location. It is already rapidly improving. The M. and B. R.R. has just been finished, and another to Albany and Eufaula is building. The idea is thence to connect westward and make Brunswick the great cotton-shipping port.

The orange fever has raged for some years in Florida with great violence. When put on paper that a tree yields so many oranges, and that there are so many trees to an acre, and each orange worth so much, an immense profit is made out. It is also represented to be a very easy way of making a living. But it must be remembered that it takes years for an orange grove to grow and bear well, and good orange lands near transportation are already taken up, and sell very high, and when hauling comes in profit goes out. As Col. Haines, of the A. and G. R.R., says, "I want the line of my road, and Florida too, settled up by Northern people, but they must not expect to find any place here that they can live without work."

Savannah is a very active place, and has this year largely increased its cotton shipment. The town has a sandy soil and is almost a perfect level. It is supplied with water by pumping to the top of a reservoir tower, from which the water is distributed to the city. The pressure is not very great, but answers amply for the hight of the houses there. A great point of interest in the city is the Cemetery of Bonaventure. It is a rather private affair, but well worth a visit. The evergreen oaks hung with the somber gray moss have a melancholy look, almost an appropriate one. Savannah has no manufactures, if we except some steam and rice mills. Money is worth too much to trade in and to advance it on cotton for manufacturing.

Macon, the great interior cotton mart of the State, is similarly situated, though there was a small cotton factory run by steam, which I was informed had a rather sickly existence—more from bad management than any real permanent cause. This place is at present the great manufacturing town of Georgia, and is likely to be still greater. It is located on the Chattahooche river, which, three miles above, commences a series of falls that end near the middle of the town. From thence the river is navigable all the year to the Gulf. The hight of this fall is about 165 feet. On this line there are three factories and one large flour mill. The upper factory, called the Columbus Manufacturing Co., R. H. Chilton, President, owns land up and down the river for a mile, and has a fall of 42½ feet, with water and sites sufficient to run 600,000 spindles. The factory now contains only 4,000 spindles and 96 looms. The pickers and cards are English, the rest American machinery.

Next below and in the limits of the town is the Muscogee Factory, running 4,000 spindles and 60 looms. The building is not full. The looms and spindles are American, the cards English.

The other mill is the Eagle and Phœnix, and is the largest in the South, having lately been enlarged. As it has a wide-spread reputation not only for the character of its goods, and its good management, but also from its using in so great measure English machinery, I will notice it more fully. The power used is in each mill or building—two double Leffel turbines, 56 inches in diameter. Other wheels in each drive the pickers, and one stands ready to drive a fire pump. Another 40-inch wheel drives the workshop machinery. Hight of fall is 14 feet. The two mill houses are 220 × 57, and five stories high. The picker room is 80 × 40, and three stories high. The finishing room is 120 × 40 feet. The dye-house is 120 × 40; and the machine shop 54 × 50. The office and ware-room building is 124 × 40, and two stories high.

They run 18,000 cotton spindles and 2,000 woolen spindles, All the woolen and about two thirds the cotton spindles are American. Of the looms, 8 run on cotton blankets, and 60 on woolen goods; 186 are American, and 350 are English. Of the American looms they have nearly every make, and endeavor to use every new improvement that promises to be valuable. An experienced Glasgow dyer does their work in that line.

I asked as to the value of the English machinery compared