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Contents:

(Illustrated articles are marked with an asterisk.)

AN INVENTION WANTED TO CLEAN THE STREETS OF SNOW. SOLUTION OF THE PROBLEM TO BE FOUND IN STEAM.

The municipal government of the city of New York pays, we understand, fifty cents per load of twenty-seven cubic feet for carting away the snow from the streets. During the last few days, heavy snow storms have visited the city, and the bill for street cleaning will amount to a large sum. Besides, the method is a very slow one, and the carts employed increase the blockade of vehicles which any obstruction to travel is sure to cause in our crowded thoroughfares.

On the principal horse railway lines the companies labor, at great expense, and with terrible exactions upon their overworked horses, to maintain their roads in a barely passable condition. As fast as their snowplows throw the slush to the sides of the tracks, it is thrown back again by the constantly plying carts, omnibusses, and other vehicles, and the work has to be repeated over and over again, until such time as sun and south wind shall diminish the volume of impeding snow so much as to render the snowplows superfluous. During the thaws the water runs to the center of the streets (the gutters being obstructed by snow and ice) and, freezing, renders the services of an army of men necessary to clean out, with ice picks and shovels, the obstructed tramways.

In reflecting upon ways and means whereby all this trouble and expense—or at least a great portion of it—might be saved, we have come to the conclusion that steam offers a complete solution of the problem. We shall explain the general principles upon which we base this belief, leaving it for inventors to devise means for their practical application.

Various authorities give as the weight of a cubic foot of snow one eighth to one fourth that of a cubic foot of water. In other words, a cubic foot of snow, melted, will make from one eighth to one quarter its bulk of water. We consider this a large estimate, but, admitting its truth, a fair average of light and heavy snow would give three sixteenths of a cubic foot of water for every cubic foot of snow melted, or 11·72 pounds of water.

To change a pound of ice or snow at 32° Fah., to water at 32° requires an expenditure of 142·4 heat units. To change a cubic foot of snow at 32° Fah. (weight 11·72 pounds) to water at 32° Fah. will require 1668·93 heat units. But as the average temperature of the snow is less than 32° Fah.—say probably about 20°—an addition of 6·1 heat units must be added for each pound melted, or 71·5 heat units for each cubic foot of snow, making the total 1740·43 heat units required to melt a cubic foot of snow at 20° into water at 32°. Probably, also, to secure the fluidity of the water until it could run off into the sewers, the temperature would need to be raised to 40° by the addition of 8 heat units more per pound melted, or 94 heat units per cubic foot of snow, making a total of 1834·43 heat units for every cubic foot of snow run off.

Steam at 212° contains 1178 heat units per pound. A pound of steam condensed to water at 40° would therefore give off 1133 heat units, and it would take 1·6 pounds of steam to melt a cubic foot of snow.

The cost of removing the snow by carting is, at present rates, a trifle over 1·85 cents per cubic foot.

A cubic foot of water is, in good steam boilers, converted nto steam at 212° by the consumption of ten pounds of coal. Some boilers will do much better than this, and some do worse, but we wish to be within bounds in our calculations. Supposing the cost of the coal to be $6 per tun, the cost of fuel to evaporate a cubic foot of water is 3 cents, but the 62·5 pounds of steam at 212°, thus produced, would, according to our preceding calculations, melt and run off 39 cubic feet of snow, at a cost of .077 of a cent per cubic foot, as against 1·85 cents per cubic foot now paid. The cost of attendance and working of the boiler would, of course, have to be added to the cost of fuel in making a complete comparison of steam with the present system of carting, which would diminish the margin somewhat, but the latter will stand a large percentage of diminution, and still show an enormous saving.

The rapidity with which steam melts snow is only appreciated by those who have tried it. Let any one who is skeptical run a rubber hose from a boiler, and let a jet of steam escape directly into the heart of a huge snow bank, and he will be astonished at the rapid collapse of the drift. Whether it would be better to use hose from boilers in the manner indicated, or in other ways that suggest themselves, we leave to inventors, not doubting that the hints given in this article will open their eyes to a new and profitable field of invention.

The use of steam would get rid of the obstruction at once and permanently; an important consideration to horse-railroad companies, and one they would not be slow to see, should some ingenious engineer put these ideas into a practical form.

THE ADULTERATION OF PETROLEUM.

The systematic adulteration of petroleum is a constantly increasing evil, and one that demands immediate reform. It is high time that the attention of the police, of the fire department, and of the press, was concentrated upon the discovery of a full and speedy remedy. The enormous manufacture of naphtha as an incidental product, for which there is little demand, offers a great temptation to dealers in petroleum to increase their profits by the admixture of the dangerous ether; and the lax state of our laws, and the carelessness of the insurance patrol, tend to perpetuate an evil that ought not to be tolerated for a moment in any well regulated and civilized community.

What can be done to prevent the dangerous adulteration of refined petroleum, is a question of the utmost importance to all who burn it as an illuminating material.

Unfortunately, most of the regulations adopted by the police, or by the legislature, have thrown impediments in the way of trade, without producing any good results. The authorities are in the habit of representing petroleum as a highly inflammable and dangerous substance, when in fact, the refined article, free from naphtha, is scarcely more dangerous than sperm oil. The storage of large quantities of petroleum in the business portions of cities, has been prohibited under severe penalties, and these regulations have been prepared as if petroleum were gunpowder. The idea seems to prevail that the refined article is just as explosive as the crude, while it is really less inflammable than alcohol, about the storage of which no such stringent rules are laid. Alcohol takes fire the moment a burning match is applied to it; properly refined petroleum does not ignite, does not flash, as it is called, until it has been heated up to 100° or 110° Fah. Alcohol more readily evolves combustible vapors; well refined petroleum forms neither gases nor vapors, and evaporates, even when exposed in shallow vessels, very slowly, and in the summer does not occasion the formation of explosive gas mixtures; in fact, it is not nearly so dangerous as we are in the habit of suspecting. Throwing obstacles in the way of its sale does not appear to be the best measure to prevent accidents. If the authorities, in the interest of the public, are willing to take the matter in hand, it will not be difficult to suggest a remedy. It will only be necessary to make a distinction between a safe and a dangerous petroleum, and to publish a single test, by the use of which, this point can be easily settled. The taking of the specific gravity is worthless, because the adulteration by the lighter naphtha can be disguised by the addition of a heavy oil. The color and odor are also not to be relied upon. The only reliable test is the temperature of the flashing point; that is, the temperature at which the petroleum takes fire when a burning match is applied to its surface. The test can be easily applied. Into a flat dish or saucer, pour the oil to be tried, until it is at least half an inch deep; then hold a burning match or taper near the surface. At the point of contact the combustion is often very lively, as the taper draws up some of the liquid, but if the petroleum be safe and free from naphtha, the flame does not spread over the surface. If the petroleum have been adulterated, as soon as the match touches the surface a blue lambent flame flashes across it, and in a few moments the body of the oil will be on fire. Such an oil is dangerous—liable to explode in lamps, and to give off inflammable vapors at all times. Any oil which takes fire when a match is held near its surface, and continues to burn, ought te be condemned at once and thrown into the streets. We lay some stress upon this experiment, because we have actually seen a country merchant pour petroleum into a saucer and ignite it in this way as a proof that it was not dangerous.

There is no doubt whatsoever, that all of the accidents can be traced to adulterated and worthless petroleum. The pure article never explodes in lamps, even when they are filled at night, with a candle by their side; but it is never safe to try this experiment, as we cannot rely upon the quality of the oil we buy. The sale of petroleum containing naphtha ought to be stopped at all hazard, and if a police officer were detailed to walk up and down before the store to warn all customers of danger, and the names of the iniquitous tradesmen were to be publicly posted, and heavy fines were to be imposed, the great loss of life and property that has been occasioned by this nefarious business would justify the severity of the measures adopted to repress the evil. We need some stringent laws on the subject, and after they are passed, let them be enforced without fear or favor.

"AND THERE WERE GIANTS IN THOSE DAYS."---THE LARGEST INVENTOR YET---A MOST REMARKABLE FAMILY OF GIGANTIC TURKS.

On Friday, January 27, the floor of our office trembled under the tread of the largest client that ever pressed its boards since Munn & Co. commenced business. Seating himself at our desk, on a chair (as much out of proportion to his bulk as an ordinary baby's chair would be to a common-sized man) this huge individual explained to us the nature of an invention for which he was desirous to secure a patent. Having transacted his business, and created a very unusual sensation among the numerous attachés of the office, he rose to depart. On his way out, our associate editor adroitly approached him, and succeeded in gaining from him the following statement, the publication of which, in our sober columns, will, we are sure, minister to that love of the marvelous, a trace of which always remains, even in the most philosophic bosom.

The name of the individual referred to is Colonel Ruth Goshen, and he resides at present in Algonquin, Ill. He is a native of Turkey in Asia, and was born among the hills of Palestine. He is the fifteenth, and last child (the baby) of a family of fifteen—ten sons and five daughters—sired by a patriarch now 90 years old, living in the valley of Damascus, and by occupation a coffee planter. This venerable sire weighs, at the present time, 520 pounds avoirdupois, and his wife, aged 67, weighs 560 pounds.

The entire family are living, and not one of them weighs less than 500 pounds. The oldest son weighs 630 pounds, and the youngest, our huge client, outstripping them all, weighs 650 pounds. Not one of the family is less than 7 feet in hight, and the Colonel is a stripling of only 7 feet 8 inches in his stockings. He is not an unduly fat man, is merely what would be called moderately portly, and is 33 years old.

He was a colonel in the Austrian army in 1859, and a colonel commanding in the Mexican army at the battle of Puebla, May 5th, 1862, in which the Mexicans were victorious. His father at one time resided in Leeds, Eng., but returned to Turkey in 1845.

The colonel states that there has never been any sickness in the family to speak of, and that all are—so far as he knows—well and hearty. It was at Leipsic, Germany, that the colonel met his fate in the person of a fair *mädchen*, weighing 190 pounds, and 5 feet 9 inches in hight, and the union has been blessed with two sons, who give promise of rivalling their father in stature.

The colonel is a finely-proportioned man, and walks with a firm and elastic step. He is as straight as an arrow, and has coal-black eyes, hair, and mustache.

He is an actor by profession. He informs us that his last engagement was at Simm's Theater, in Baltimore, and that he expects to play an engagement in New York during the present season.

EXCAVATION AND EMBANKMENT TABLES.

The preparation of these tables, for the use of engineers and contractors, involves an amount of labor, even when worked out by means of differences or increments, which those who have calculated them can well appreciate. The labor in calculating, say a table increasing by one tenth of a foot, up to seventy-five feet in depth or hight, with one hundred feet stations, or less, by the rules of areas and distances, would be immense; and the table liable to errors, there being no general check on its accuracy; and by differences or increments, the labor would still be great, and the liability to error not much decreased.

We have lately been shown a simple, rapid, and correct method for making such tables, discovered by G. R. Nash, C.E., of North Adams, Mass., which we insert for the benefit of engineers and others, whereby much valuable time may be saved. Rule—

1. Arrange the hights or depths for calculation in vertical columns, each of 27 lines.

2. In any three (3) columns, the third column is equal to twice the second, plus 81, minus the first column (where the depths increase by tenths of a foot, with 100 feet stations).

Note—

1. For shorter or longer stations than 100 feet, add the proportional part, or multiple, of the quantity required to be added for 100 feet.

2. For increasing the series of hights and depths, multiply 81 by the square of the increment in tenths, and the product will be the constant number to add.

3. Verify in any table calculated, the last column, which proves the whole, as any error in any of the preceding columns, increases in geometrical progression to that column, and being greatly magnified, is at once discovered.

4. In compiling any table, it is necessary to calculate, by areas and distances, the first two columns, after which the table can be extended to any length by the above process.

If any one knows an easier, more rapid, or more accurate method than this, we should be glad to hear of it.

THE ALLOYS OF COPPER.

From time immemorial, copper has been extensively used for forming compounds with other metals. The ancients whose works of art still remain to us, appear to have wrought it chiefly in combination; and, at the present day, the employment of the pure metal is less general than that of its alloys. It is not improbable that copper will unite with all the metallic elements, but its alloys with zinc, tin, nickel, and the precious metals, are the most valuable and best known. The most useful is "brass," consisting essentially of copper and zinc. It is first mentioned by Aristotle, who states that the people who inhabited a country adjoining the Black Sea, prepared their copper of a beautiful white color by mixing it with an earth found there, and not with tin, as was the custom in other lands. The ancients, however, were not acquainted with the nature of the change that took place; and it is a remarkable example of the slowness by which man arrives at truth when led by experience alone, that brass should have been made during a period of 2,000 years without the metal which brought about the change in the copper being discovered. Brass was made with the utmost secrecy in Germany during several centuries, and some families were raised to great opulence by its manufacture.

The first brass works in England were put into operation in 1649, in the county of Surrey, and the whole of the metal was then made of "rose" copper from Sweden. The first mill for drawing brass wire was erected in 1663. The advantages of brass over copper are its less cost, it being partly composed of a metal cheaper than copper; it is harder, does not oxidize or rust so easily; it melts at a lower temperature, and is hence better for small castings; it has not that tendency to fill with minute bubbles, which property is so disadvantageous in copper founding; it cuts smoother in the lathe, and will bear a higher polish; its color may be made to resemble gold, which adapts it for ornamental purposes; and, lastly, it is more ductile and tenacious. Generally, as the proportion of zinc rises, the hardness and fusibility increases, while the malleability and weight decrease. The brass founder in speaking of his mixtures, specifies the amount of zinc only, it being understood that the ratio is to the pound of copper. The largest consumption of brass is in the manufacture of pins. Brass foil is made from a very thin sheet of brass of 11 copper to 2 zinc.

The next alloy in importance is called "bronze." Tin is now substituted for zinc. Like brass, it is harder and more fusible than copper, and denser than the mean of its constituents. Its color is usually reddish-yellow, but when exposed to the air, a basic carbonate of copper is formed, which furnishes the greenish hue commonly seen on the surface of statues, and by which the alloy is best known. Bronze possesses the singular property of becoming so malleable, that it may be hammered and coined when it is heated and rapidly cooled; and by heating it, and allowing it to cool slowly, it may be made to regain its former hardness and brittleness. Bronze for statuary, for cannon, for bells, and for gongs, is, respectively, of the following proportions of copper and tin: 84 to 11, 89 to 11, 78 to 22, 76 to 22.

Speculum metal is the third alloy in importance, the standard proportions being about 66 copper to 34 tin. The speculum of the great Rosse telescope is composed of copper, with a little less than half its weight of tin, making a composition very hard and brittle, and capable of very fine polish.

German silver is a mixture of copper, 57, nickel, 24, and zinc, 13, and originated in China under the name of "packfong." Large quantities are manufactured at Sheffield, in England, where it is formed into forks, spoons, and vessels for the table, and being plated with silver by the electrotype process, is sold as a substitute for silver. When well made, it cannot be distinguished by an unpractised eye from many of the silver alloys, even when brought on the touchstone; but by dissolving a small piece in nitric acid, and adding a few drops of hydrochloric acid, no milky precipitate is formed, which would be the case were a silver alloy so treated. Good German silver is tougher and harder than brass, and resists the action of air better. Lastly, copper is used, in various proportions, to give the requisite durability to gold and silver coins.

The foregoing are the principal alloys of copper; there are a number of others, the names and properties of which are known to artisans. An alloy of 90 copper to 10 arsenic, is white, slightly ductile, and more fusible than copper, and is not attacked by the atmosphere. This is used for scales of thermometers and barometers, for dials, candlesticks, etc. With iron, copper combines in small proportions; 1 per cent, however, causes iron to weld badly. With aluminum it forms an alloy of considerable malleability and great hardness, capable of taking a very high polish.

THE DOWNFALL OF PARIS.

"Plenty more at the same shop. Country orders executed with neatness and dispatch," exclaimed the renowned Dick Swiveller, after administering a wholesome chastisement to Quilp the Dwarf. The facility with which that well-earned drubbing was administered, and the profound repose with which the chastiser rested upon his laurels, have been, to illustrate great things by small, repeated in the Franco-Prussian war, and in the attitude of Germany toward France, in the hour of her deserved humiliation. France has been whipped as easily as Dick Swiveller punished the dwarf, and her capital has succumbed to a fate that has long been inevitable.

The causes which led to the war have been sufficiently discussed; the causes of the defeat of France, and the effect which the triumph of the German arms will have upon Europe and the world at large, are fruitful themes.

Many will attribute the Prussian success to superiority of numbers. Others will see in it only a triumph of one breech-loading gun over another. Others will see deeper reasons in the difference of the character of the two nations, and, searching for the cause of the difference, will find it in their systems of education, which, on the one hand, has created a nation of educated soldiers, and, on the other, has led to the mental, moral, and physical degeneration of a nation, once the terror of all Europe.

We quote the following eloquent extract from an article written for the London *Fortnightly Review*, by Emile De Laveleye:

The most formidable corps in the French armies was, it used to be said, the Turcos and the Zephyrs. They met men in spectacles, coming from universities, speaking ancient and modern languages, and writing on occasion letters in Hebrew or Sanskrit. The men in spectacles have beaten the wild beasts from Africa. In other words, intelligence has beaten savagery. Are we to be surprised at this, when we know that war, like industry, is becoming more and more an affair of science?

Who does not know the immense sacrifices that Germany has made for the advancement and diffusion of knowledge—spending, for instance, twenty thousand pounds sterling at Bonn in a chemical laboratory, forty thousand at Heidelberg in a physical laboratory? Little Wurtemberg devoted more money to superior instruction than big France. A thing unheard of, France made the very fees of the university students a source of revenue. She gave, without counting it, more than a couple of millions of pounds sterling (between fifty and sixty million francs) for the new opera, and she refused forty thousand pounds for school buildings. Last year, on the deck of the steamer which was conveying us to the inauguration of the Suez Canal, M. Duruy, the one man of merit who ever served under the imperial government, told me the tale of his griefs in the ministry of public instruction. He wanted to introduce compulsory education; the Emperor supported him; he had all the other ministers against him. He had organized fifteen thousand night schools for adults; it was with difficulty that he succeeded in carrying off forty thousand pounds against the fatuous resistance of the Council of State. There was the whole system of public instruction to re-organize, and he could get nothing. They preferred to employ the gold of the country in maintaining the ladies of the ballet, in building barracks and palaces, in gilding monuments, the dome of the Invalides, the roof of the Sainte Chapelle. It was in vain that men like Jules Simon, Pelletan, Duruy, Jules Favre, cried out, year after year, "There must be millions for education, or France is lost." The Government was deaf. It denied nothing to pleasure, to luxury, to ostentation. It denied everything to education.

Again history repeats itself. Again a nation surrendering itself to the utmost refinement of luxury, and disseminating false tastes and demoralizing influences from its Capital to corrupt other nations, has found itself in the hour of peril, unable to resist an attack from a frugal and industrious people, by whom its luxury and pomp has been crushed into the very dust of humiliation.

A daily exchange has asked the question, How much debt can a nation endure and maintain its existence? and thinks the enormous debt of France will throw some light on this question. *We* ask, has it not been demonstrated in this short and decisive struggle, how much luxury a nation can endure and live?

For a long time, Paris has been the fashionable exemplar of the civilized world. What has been done in Paris has been feebly imitated in America, and has more or less influenced the diet, manners, dress, and even the literature of all other nations. The stage has been corrupted by it, and the polished iniquity of the modern Babylon has tainted, more or less, the morals of every capital city in the world. Babylon has fallen. It remains now to be seen whether the seeds of evil which have hitherto emanated from the chastised city, will exert their demoralizing power to the downfall of other nations.

There is no truth more deeply engraved on the pages of history, than that extreme luxury begets a contempt for the homely industries of life, a disregard of a high standard of popular intelligence and the means of maintaining it, a contempt for severe discipline, and rebellion against it, and a general weakness of character that renders a nation powerless against a race of sturdy, intelligent, enduring, and united people.

This war has been a triumph of knowledge and subordination over ignorance and insubordination; of settled earnest principle and purpose over passion and impulse; of thorough organization and fixed policy over incompetency and vacillation of purpose. It teaches a lesson all nations would do well to learn.

In this war the "spectacles" have won 800,000 prisoners, including the Emperor and the Marshals of France, 6,000 cannon, 112 eagles, and a large quantity of stores, munitions, and small arms. And all this has been done in a time so short, that history may be searched in vain for a precedent. The humiliation of the French nation is complete; perhaps the military pride of Germany will be stimulated in equal proportion, but we believe that a nation educated as are the Germans, will know how to use power in a manner that will add to, rather than diminish the glory of their great victory.

BOYNTON'S LIGHTNING SAW.

In another column will be found an advertisement of this saw, to which we would call the attention of those interested in the cutting of timber and cord wood, and in the manufacture of lumber. The teeth of this saw are of even length, double pointed, cutting only with the outside vertical and projecting edges, and clearing simultaneous with the same. All the teeth being M shaped, they are as easy for the unskilled laborer to sharpen and keep in order as the old-fashioned tooth. The two points of the tooth operate as one, preventing gouging out while cutting, and clearing by direct action beneath dust and fiber. These saws are gaining in public favor rapidly. In a trial of a cross-cut, operated by two sawyers, it, in our presence, has repeatedly cut off a beam of white oak, 12 by 6½ inches, in from five to seven seconds, and with from 8 to 10 strokes of the saw. The invention will, we think, greatly lessen the labor of a large class of the most industrious and hard-working men to be found on this continent—the lumbermen—and its use will result in a saving of both wood and labor, in the cutting of cord wood.

THE PRESENT AND THE PAST.

NUMBER III.

Why did mankind for so long a time fail to recognize the existence and the magnitude of the effects produced by these unceasing agencies of destruction? In great measure, because the ideas of civilized men, regarding the earth and its history, were cramped within the narrow scope of each one's limited, individual experience. Men living in temperate climates did not dream that in the circumpolar regions millions of tuns of rocks were annually riven from those frost-bound lands, were borne down to the sea upon the great glacier-rivers, and were set afloat on icebergs, to be finally scattered far and wide over the beds of distant oceans; nor did they ever calculate what would be the effects of a tropical rainfall, two, three, four, or even twenty times heavier than any which they themselves had ever witnessed; much less did they think of multiplying the mass of material removed in a single year by its repetition over a long series of past ages.

What if a village here and there, along the coast, were driven back, step by step, house by house, by the steady encroachment of the sea; what if its ancient church, formerly miles inland, now toppled on the verge of the treacherous cliff, and the bones of the dead in its churchyard, here projected from the topmost layer, there lay fallen on the beach, the prey of the relentless foe? This might be taking place in our village, but which of us reasoned, from these premises, that the whole coast of the British Islands—allowing for the few local exceptions, where sand banks or river rills are slightly encroaching on the sea—was being eaten into at an average rate of perhaps three feet in a century? Ours were clay cliffs, and readily crumbled; but the granite walls of Cornwall, whoever deemed them perishable, much less thought of estimating the rate of their destruction?

But, now-a-days, when each one of us may work the experiences of travelers in all parts of the world into his chain of reasoning, no one has a right to claim ignorance of these truths of nature. Read what Kane and Hayes have written of Greenland glaciers, and of the origin of icebergs; read what other explorers tell of the vast number of icebergs engaged in the unceasing task of burying the remains of the Antarctic continent in the waters of the great Southern Ocean; read what Alpine travelers narrate of the incessant crashing of displaced rocks, and constantly recurring roar of avalanches, laden with the ruins of the mountains, whose cliffs re-echo these, the prophetic sounds of their future doom; read such accounts—and they are at least as interesting to a well-cultivated mind as political diatribes, or sensational novels—and you will form some idea of the grand scale of King Frost's labors, and of the littleness of your own unaided experiences.

We know what heavy summer showers are in New York, where the annual rainfall is double that of damp, foggy London; but our rainfall is only half of the average under the equator, in which zone, moreover, there are vast regions that seldom, or never, receive even a passing shower, thus greatly raising the average of the other portions. In fact, we cannot rightly estimate the force of the rainfalls in the warmer parts of the earth by comparing total averages; the rain in those regions falls in a downpour concentrated into the course of but four or six months; a condition of things admirable described by the Indian lady, bewailing the rainy season:

> "They count our rainfall up in grudging measure,
> With gages all too shallow for our woes;
> They talk of inches of the liquid treasure—
> When we have yards with every wind that blows!"

And this is scarcely exaggeration. More rain has been recorded as falling in localities in India and Australia, in twenty-four hours, than falls in London in the whole year.

We read in Lyell of places where the rainfall amounts to 530 inches in six months, or about eleven times as much as falls in New York in the twelvemonth! No wonder that of such regions he adds: "Numerous landslides, some of them extending three or four thousand feet along the face of the mountains, composed of granite, gneiss and slate, descend into the beds of streams and dam them up for a time, causing temporary lakes, which soon burst their barriers. 'Day and night,' says Dr. Hooker, 'we heard the crashing of falling trees, and the sounds of boulders thrown violently against each other in the beds of torrents. By such wear and tear, rocky fragments, swept down from the hills, are in part converted into sand and fine mud; and the turbid Ganges, during its annual inundation, derives more of its sediment from this source than from the waste of the fine clay of the alluvial plains below.'"

You who watch the roadside rill perhaps have never thought what millions of such muddy streamlets are engaged all the land over in Nature's great freight trade; aye, and what millions of tuns of earthy freight they each day transport onwards towards the sea. The Ganges and the Brahmapootra have their sources in such rills, and it has been calculated that these two rivers together carry down from the interior of Southern Asia to their common delta about 2,500,000,000 tuns of solid matter in the course of the year. To modify Lyell's statement, if a fleet of more than 600 Indiamen, "each freighted with about 1,400 tuns weight of mud, were to sail down the river every hour of every day and night for four months continuously, they would