for the fact that the contrivances used for the purpose are still very defective. Hence, steam is mostly employed, and this process is easy and inexpensive. Yet there is one disadvantage connected with it, as the cocoons absorb moisture; and if not dried with the utmost care, they require afterwards to be turned over several times a day to prevent their loss by decay. In foreign silk growing countries, much care is bestowed upon this branch of the art. In China, for instance, they use *calorifères*, specially built in Paris with great care. To facilitate transportation, the cocoons are treated in hydraulic presses, whereby spots will most assuredly show themselves if the dead worms have not been perfectly dry. In order to simplify this process, Alcan conceived the idea of employing a volatile substance (camphor) which he did in the following manner: Thirty pounds of cocoons, which were to be sent from southern France to Paris, were packed into a box with a small quantity of camphor, all the cracks having been carefully closed by pasting strips of paper over them. Although forwarded at a time most favorable to the metamorphosis, not a single butterfly was found on opening the box; all the cocoons were saved, and the worms had assumed a mummy-like appearance; they were black, hard, and caused no spots. From these facts, it may well be inferred that this process may well be used in the killing of the silkworm.

Alcan called attention to another operation, namely, the filature or reeling, an apparently simple but important part of the treatment, and one that must be very carefully carried out. To fully appreciate the importance of the improvement to be described, it may suffice to point to the fact that formerly the silk from Persia, China, and the Levant commanded a much higher price than the French production. This condition of things has been changed; for in Europe the silk is now treated differently from the process still followed in Asia. For the better understanding of this operation, let us mention the principal points required in reeling. The most common, as well as the finest, raw silk consists of at least three or four single threads, as many as there are cocoons thrown into hot water which is used for the purpose of softening the threads and to separate them from each other. These single threads have unequal cross sections, and are unequally thick throughout their length; and, moreover, they are not round, but rather flat. Great care is necessary to produce a uniform thread; it should be smooth and brilliant, and when torn should not divide itself; if it does, the union between the single threads has not been perfect. The unification is accomplished by twisting the fibers on their way from the hot water basin to the reeling machine, and it is consequently important that the length of the twisted part should remain unchanged during the reeling of one kind of silk. It is said that to this end Vaucanson has constructed a very simple but ingenious apparatus, which seems to answer all purposes. Unfortunately Alcan has neither furnished an engraving nor a clear description of the invention.

Another point that is very important is that the number and equal strength of the threads should be maintained. As the filature progresses, the diameter of the thread varies; and for this reason, new cocoons must be used from time to time in order to equalize the variation in thickness. The successful performance of this operation requires an apprenticeship of from two to three years.

The third point to be observed relates to the luster of the product. If the threads have not been properly reeled, they exhibit, when magnified, arch-like twists and appear downy. But if they have been stretched in a straight line, they reflect the light, and attain the luster peculiar to properly treated silk.

The improvement made in the art of reeling consists principally in the application of steam power. By this the velocity may be regulated at will, and if the cocoons are well freed from the gummy substance, the operation may readily be carried out. The product obtained is in every respect superior to that obtained by hand; and the process was imperfect as long as hot water, which it is not easy to retain at a uniform and sufficiently high temperature, was used. The stuff called *paquetaille*, a common product, was largely obtained as waste by the direct application of heat.

So long ago as 1810, Gensoul introduced the heating by steam, and from this time dates a new epoch in the manufacture of silk. Two or three years since, a new method for applying heat has come into use in the silk districts of France. The inventor is the manufacturer Limet, of Coisne, department Nièvre, and the principle consists in the alternate or combined action of water and steam, the operation being effected by the alternate opening and closing of stop cocks. The first stop cock furnishes steam with which the cocoons are to be softened; by opening a second cock, they are impregnated with water, which is heated by the steam. If allowed to remain in this position they would sink to the bottom of the basin, which would be a great disadvantage; a third stop cock is therefore opened, by which the water is allowed to reascend, whereupon the cocoons swell, diminish in weight and again ascend to the surface. This operation requires from two to six minutes, according to the hardness, species, or origin of the cocoon. After this preliminary treatment, the reeling is done with great ease, so that the operatives, although generally opposed to innovations, are not likely to return to the old method if they have once used this process. Not only is the silk improved in appearance and the production increased twenty per cent, but defective cocoons may also be reeled without much loss or trouble. Besides, one cocoon or one hundred may be treated with equal certainty.

The invention is characterized by the following considerations: 1. The steam acts uniformly on all cocoons. 2. By the boiling in water mixed with steam, the friction of the cocoons among themselves, which causes loss, is entirely obviated. 3. By the subsequent application of steam, the water is driven out from the cocoons, so that they are caused to float.

The advantages claimed are: 1. The more carefully prepared cocoons can be better reeled, there are fewer ruptures and less loss, and the workmen are enabled to produce one fifth more silk. 2. The silk is smoother, and without down, to which all manufacturers of glossy goods object; it is cleaner from gum and more uniform and strong. 3. The apparatus saves labor, fuel and time.

### INTOLERANCE IN SCIENCE.

We have received a pamphlet entitled "On Force of Falling Bodies and Dynamics of Matter, classified with precision to the meaning of dynamical terms, by John W. Nystrom, C. E." It contains 29 pages, of which, to our disappointment, we find 20 filled with different articles published in 1865 and 1872 in the SCIENTIFIC AMERICAN, only 5 pages of explanation of the author's views on the subject, while the remaining 4 are filled, not with scientific refutations, but with personal abuse of his antagonists, who appear to be very numerous, and from among whom he especially singles out Dr. Vander Weyde, saying: "It will do no harm to tell the truth to one of them, every now and then .... equally applicable to all the rest of the high authorities who have invariably attacked me. . . When my ideas differ from what is written in their books, they blindly suppose that I am wrong," etc. He further threatens that he will warn the university where Dr. Vander Weyde graduated of his erroneous philosophy, and "if that university cannot sustain its doctor's statements, he ought to be called back and made to study over again, or be requested to return his doctor's diploma."

We have already in our paper of July 29 and September 9, 1865, given our opinion concerning Mr. Nystrom's views; they agree perfectly with those of the National Academy of Sciences, which met in Washington that same year, and would not accept Mr. Nystrom's papers on that subject, as his method of explanation rather confused than elucidated the matter in question; we are, therefore, not inclined to go into any argument at present, but will only remark that it strikes us as not a little curious that Mr. Nystrom finds so much fault with Dr. Vander Weyde's disagreeing with the books and accepted views, while Mr. Nystrom himself boastfully proclaims that the books and accepted views are erroneous; thus he is guilty of the same offence. Only the manner differs in which both gentlemen disagree from the books, and this appears to be very distasteful to Mr. Nystrom.

We are aware that in theological colleges the diplomas are sometimes withdrawn when the graduates preach heresies, not sanctioned by their orthodox *Mater Alma;* but we wish to remind Mr. Nystrom that science is eminently tolerant, and that a graduate, after having been taught the prevalent scientific doctrines in college (and we are convinced this was the case with Dr. Vander Weyde) is at full liberty to promulgate afterwards new scientific ideas or philosophies, without fear of being prosecuted, called back, or having his diploma annulled. On the contrary, such attempts are considered praiseworthy, as without them science would not progress; we are, therefore, far from blaming Mr. Nystrom for trying to promulgate and defend his views, only he must acknowledge that others have a right to the same privileges, which nobody wishes to deprive him of, even if they cannot agree with his peculiar notions, whether they be on velocity of thunder (see SCIENTIFIC AMERICAN of August 24, 1872) the decimal and tonal systems, or the force of falling bodies, etc.

### SCIENTIFIC AND MECHANICAL POSSIBILITIES.

One hundred and fifty years ago, if any one had dared to announce the possibility of crossing the ocean in a vessel driven by steam, or of carriages being driven at the rate of thirty miles an hour by this same agent, or of daguerreotyping the human face on a metallic plate by the light of the sun, and then chemically fixing it there, or of conveying news by electric agency for hundreds of miles, and specially under the ocean, such predictions would have been considered simply ridiculous. And now when science announces that it is possible to control the elements, to cause it to rain or shine at pleasure, and that it is possible to draw from the earth's hidden treasure new resources of untold wealth, imparting the greatest happiness and benefits to the human race, it is still viewed with incredulity by the masses. But a few years since, petroleum was first utilized to our benefit. There doubtless was a time when man never dreamed of warming himself by artificial heat. For ages the savage did not know that the possibility of heat existed in the trees under whose shelter he lay. He pulled up wild roots, picked wild fruits, swallowed the raw oysters and mussels as he wandered naked along the beach. A cave by the river or seaside, or a hollow tree, served him for a shelter. Many generations passed before he learned to make a fire; by slow steps he passed from rude tents, huts and cabins, to comfortable houses and stately mansions, with heating apparatus, by which winter is shorn of its vigor.

Heat increases about one degree to every fifty feet that we penetrate the earth; shafts are now sometimes sunk to a depth of 2,000 feet. It is not within the possibility of mechanism to bore 4,000 feet more; at that depth we should find a heat of at least one hundred and fifty degrees, and in many places even greater than this. Mechanical power could be obtained from the steam and water forced up from this depth. Heated water and steam from these wells could be carried into our houses and warm our dwellings to a summer temperature. Conducted in pipes under the soil protected by glass, we could cheaply grow, in New England, all of the southern and tropical plants and vegetables. The snow could be kept melted from the streets of New York, and all of the buildings warmed from this spontaneous flow, useful also for cooking and other purposes.

The Garden of Plants in Paris is heated by water from an artesian well eighteen hundred feet deep, which has a temperature of 82° Fah., and is carried in pipes under the soil. A salad garden at Erfurt, in Saxony, is heated in the same manner, and is said to have yielded $60,000 a year to the proprietor. J. E. E.

### Deep Well.

At the village of Sperenberg, about twenty miles from Berlin, a well has been sunk to the depth of 4,194 feet. A shaft was sunk in this locality, because the known existence of gypsum there led the explorers to infer that they might possibly find a mine of rock salt. At the depth of 280 feet, they dik reach the salt, and continuing on they passed through the salt deposit, 3,907 feet, without having reached the bottom of it. The boring would have been continued to ascertain what deposit lay under the salt, but the mechanical difficulties were too great. The greater part of the boring was done by steam.

### THE CONFLAGRATION IN BOSTON.

Another calamity involving the loss of millions of money and valuable property has happened in our midst. Boston, following the sad fate of Chicago, has fallen prey to the flames, and sixty-four acres of her finest buildings lie a heap of ruins. The district burned over is bounded by Summer, Washington, Milk, Congress, Water, Kilby, and half of Central streets, proceeding therefrom in nearly a straight line to Broad street and thence to the Boston, Hartford and Erie Railroad depot. In it are inclnded Otis, Arch, Hawley, Franklin, Devonshire, Matthews, Perkins, High, Purchase and Pearl streets, besides a large number of alleys and places. The fire was discovered on Saturday evening—the 9th inst; and before the engines could arrive, it had spread to the the mansard roof, setting it in a blaze, which, favored by a strong wind, in less than half an hour was communicated to the entire block. So fierce and terrible was the heat that it was impossible for the firemen to remain at their posts; and the granite front walls, of which many of the buildings were composed, cracked and exploded, falling in fragments upon the street. No structure, however massive, opposed the slightest resistance to the flames. Aid was obtained from adjacent cities; and after twenty-four hours labor and the blowing up of several blocks of splendid buildings, the fire was at last brought under control. But in the course of a few hours it broke out afresh, owing to gas explosions, the result of negligence in not shutting off the mains leading into the burned district. Thirty-six hours in all elapsed before the fire was fully reduced. The estimated loss, which will be felt over the entire country, is ninety millions of dollars. Seven hundred buildings, embracing, perhaps, the finest specimens of city architecture in the world, were destroyed.

The fate of Boston enforces more strongly the lessons taught by Chicago, which pointed out the radical defects existing in our modern method of building. The first details of the catastrophe tells us that the flames burst with their greatest fury from the mansard roofs. It is to this imported innovation in architecture that many of our most disastrous conflagrations are due. At the present day in this city, there are scores of these roofs surmounting buildings that are mere fire traps, shells of light, dry beams covered with thin tin or slate, and inviting, by their immense surfaces, immediate ignition from burning buildings in the vicinity. Many of our so-called fireproof edifices are mere skins of iron and masonry, with wooden floors and fixtures, the firing of which twists the iron and tumbles down the whole structure. Our partition walls are too generally made of scantling and lath which receive no protection from their light casing of plaster. If French roofs must be built, the law should require that the walls extend clear up to the decks so as to afford some shield to the light frame work. Wooden church steeples are wisely forbidden in the city, and the same prohibition should be extended to the mansard.

Buildings in crowded localities should be rigidly required to be fireproof, and the use of wood in their construction denied. Interior walls should be of plaster, made in sections and built up, the interstices being filled with dry plaster or other non-conducting and non-inflammable material.

The reports of the late casualty indicate a deficiency of water. With great rivers and bays at the very doors of almost all our large cities, there is no reason why we should not have a most abundant supply. In New York, towers might be built at points along the island which might be kept filled and communicating with pipes laid through all the streets. A powerful head might thus be obtained, and the water be always ready under constant pressure. Or suitable pumping engines of the Holly type might be employed, which, drawing from adjacent rivers, would materially relieve the ordinary fire apparatus.

It should be rendered obligatory to place pipes carrying water through large establishments, so that the entire interior might be drenched by the turning of a single cock. We have heretofore alluded to an excellent system based on this principle, which has been amply tested in cotton mills—the most dangerously inflammable of factories—with every success.

For buildings already erected, such as crowd the narrow thoroughfares of the lower portion of this city, it is imperatively necessary that adequate means of protection from fire be devised and applied, and inventions leading to such are sadly wanted. Wide streets and isolated warehouses have thus far proved to be the only really efficient safeguards, and in further extensions of our cities, this experience will doubtless be turned to profit.