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Contents:

(Illustrated articles are marked with an asterisk.)

WOOD ENGRAVINGS.

Not the least of the means by which science and knowledge are disseminated at the present day, and by which the present stage of civilization has been reached, is the art of wood engraving. So far has its power as an educational means been recognized that scarcely a primary school book is now published without illustrations.

From the ape which helps to impress upon the infant mind the first letter of the alphabet, to the zebra which performs a similar office for the last, through the first primer of arithmetic, and so on progressively to the higher studies of geometry, surveying, astronomy, physics, and chemistry, the pupil finds his imagination aided and cultivated by wood engravings; not rude, uncouth caricatures but really meritorious productions.

In our early school-days the only picture contained in any school book then in use, except the geography, was the frontispiece to Webster's Spelling Book. A picture of a female with a forbidding countenance inviting us to come up to the temple of knowledge, and giving us to understand that if we wanted to win fame, we must devote ourselves to orthography with the utmost diligence.

We are confident we fulfilled our part of that contract, but the female with the forbidding countenance has never fulfilled hers.

At that period a picture in a newspaper was a thing to be wondered at and talked about by a whole neighborhood. Now even the dailies endeavor occasionally to grace their columns with pictures, but as yet such pictures can scarcely be called works of art.

We venture to predict that men of two-score years now, will, ere they arrive at three-score, see illustrations in every daily paper as regularly as they now see the market reports.

Of course nothing good will ever be originated that the spirit of evil will not pervert to its own purposes. There now exist a large number of papers, the illustrations in which as well as the reading matter, are wholly vile, and the influence of which is entirely bad. The strong arm of the law ought to be invoked to suppress these obscene publications.

On the contrary, there are a large number of publications which teem with, in some instances, really superb works of art, the circulation of which cannot be too much encouraged, for their refining and cultivating influence on the masses.

One of the earliest illustrated papers in this country was our SCIENTIFIC AMERICAN, and the educating influence it has exercised has doubtless been to a great extent due to the able manner in which our artists have sustained this feature. In a description of machinery a stroke of the artist's pencil will often do more to elucidate a subject, than a page of verbal description.

Many an invention dates its financial success from its illustration and description in the SCIENTIFIC AMERICAN, and the study and examination of these illustrations have probably originated more useful and ingenious inventions in this country than any other cause.

HARDENING AND TEMPERING STEEL.

When we penned our recent article on the above subject, we had little idea what a sensation we were preparing. Such a shower of correspondence as has fallen upon our sanctum, and fairly snowed us in with arguments pro and con, is something we hardly expected.

This correspondence gives evidence that we did not overstate the diversity of opinion existing among mechanics. The urine theory has, we find, many adherents, one individual going so far as to say that in the variety of qualities of this fluid generated by different animals, nature had no doubt special regard for the wants of mankind. He regards the influence of urine on steel as entirely distinct from any of the ordinary forces of nature.

Of artificial solutions we have no end. Most of our correspondents believe in putting salt in the water, but those who advocate this, base their approval on the fact that it seems to prevent the spheroidal state which takes place in pure water, and thus the water adheres more closely to the iron, and cools the latter more rapidly. We are willing to concede this mechanical action of salt, but it is evident that it would not do for such grades of temper in steel as can only be obtained by slower cooling. Indeed, some tools are best tempered in water with the chill taken off.

On the other hand, we have plenty of letters from practical men who are convinced that all solutions are better replaced with pure water.

One gentleman of very long experience and every way a practical as well as a scientific mechanic, takes this ground; and, in addition to his own experience, furnishes us with the experience of Mr. N. P. Ames, late of Chicopee, Mass., who, some thirty-five or forty years since, succeeded in making sabers, swords, and cutlasses in this country, that would stand the U. S. Government tests. After expending much time and more than three thousand dollars in experiments with various solutions and baths, he found that heating in a charcoal fire, hardening in pure spring water, and drawing the temper in a charcoal flame was the best practice.

A correspondent from Chicago writes us an interesting letter in favor of the pure water practice, which we should be glad to publish, as he evidently has based his views both upon study and long practice; but our friends who favor solutions might deem us partial as we publish nothing on their side of the question. This writer seems to have touched hard pan when he says "let co-laborers discard all superstitions, solutions, incantations, etc., and pay more attention to how they heat steel before hardening, and, my word for it, they will soon lose trust in solutions."

It is time we had a new definition of steel. Any compound of iron hard enough to make some kind of cutting implements now goes by that name. The term has even been extended to alloys of iron with other metals, and when steel is spoken of a very indefinite idea is conveyed. The grade of carbonization, the presence of substances other than carbon and iron, or their proportions if present, are not indicated by the term. Upon no subject is there less accurate information diffused among the masses than that of steel, and in the absence of more precise terms by which to indicate the various qualities of what is called steel, it will be very difficult to impart accurate knowledge.

Finally, we consider that chemical reactions do not take place in the act of hardening and tempering steel, when those terms are understood to mean the process of hardening steel by sudden cooling after heating it and subsequently drawing the temper by heat. This being the case, we see no use of solutions except perhaps as in the case of a brine of common salt they cause the water to hug the metal more closely and thus facilitate the cooling. We are confident, however, that if the character of the steel be thoroughly understood previous to hardening and tempering, and heating and working be regulated accordingly, water, pure and simple, is all that is wanted to secure any degree of hardening, and the proper temper upon subsequent heating, if the latter is performed judiciously.

INERTIA AND VIS INERTIÆ.

A correspondent, in another column, under the above heading, criticises, rather more severely than ably, a recent work entitled "Force and Nature," chiefly on account of its denial that there is any such thing as inertia in matter. This correspondent charges the author of "Force and Nature" with having "entered the fourth-story window of the temple of Science," and having never descended to examine the foundations—its axioms and definitions. He might not have adopted this ingenious figure had he seen how easily the author, whom he has attacked, might turn the tables, and charge that his critic had never been able to climb from the cellar of the temple in which he has ensconced himself, and, therefore, cannot be supposed to know what discoveries and theories go to make up the upper stories of the structure.

Newton was a great man, but scientific knowledge has grown some since his day. Because he thought the term inertia an appropriate one, it is hardly safe to say that everybody who thinks will accept it as such for all time. The subject of molecular motion was very little understood in Newton's time, and, had he known what is now known, he might have modified his views.

But we have not taken up the pen to defend the author of "Force and Nature," with whose conclusions we do not agree. We have other matter of difference with our correspondent, who charges *us* with false teaching on this matter, referring to articles on pages 217 and 297, Vol. XX., for confirmation of this statement.

It is true, that in those articles we took exceptions to the term inertia, as being one variously defined, and, at best, negative in its signification; and charged that it grew out of the obsolete notion that there is a property residing in matter by which it resists motion. And notwithstanding our correspondent's reverence for the opinions of the thinkers of a past generation, we shall, in the absence of more light than we can at present attain, still hold that opinion.

We do not say, that the term inertia is now, or was ever understood by our best thinkers as applying to a state of rest alone, but it has been used, even in modern textbooks to express the idea of resistance of matter to motion. In Silliman's Physics, page 13, we find in his definition of inertia the following: "Matter has no spontaneous power, either of rest or motion." In Bartlett's Mechanics, page 20, we find: "Inertia is that principle by which a body resists all change of its condition in respect to rest or motion." In Ganot's Physics, page 7: "Inertia is a *purely negative property* of matter. It is the incapability of matter to change its own state of motion or rest." In Nichols' Physical Sciences, page 465: "The principle generally named the principle of the inertia of matter is two-fold. The first part of it *is a pure but a convenient hypothesis.* This hypothesis is that *all nature is naturally inert, motionless, lifeless; and that action or activity can be impressed on it solely by external agencies or forces. But in so far as we can form any conception of the constitution of matter, this is physically quite untrue, not an atom existing which is not the center and source of manifold and multiform activities.*"

But we have quoted enough for our purpose. We might go on quoting authors by the dozen to show that this term is not accepted as meaning the same thing by those who write and think upon it; and that it had its origin in the "obsolete notion" of the *naturally inert condition of matter.* Morin, in his Mechanics, does not apply the term to matter, *per se*, but to bodies or masses of matter (see page 8. Bennett's Translation).

The idea of the resistance of matter to motion originally grew out of the fact that time is required to transmit *mass motion.* A team of horses attempting to draw a canal boat, does not instantly move it as a mass, but it moves something immediately. Instantaneously, with the application of the power, there begins to exist the state of matter known as tension, in the harness, rope, etc., and this tension is an increase of motion in the molecules in one direction. Gradually this tension is converted into mass motion, and the boat moves. There is nothing about this to indicate that matter resists motion. It only indicates this fact, that, as we can not by any mechanical means apply power instantaneously to all the molecules of a mass, the power we do apply must be communicated from molecule to molecule throughout the mass, and this takes time.

Now is inertia, loaded down—as is every term born of false conceptions and hypotheses—with different meanings and interpretations, a good term to express this fact that time is required for a mass to impart or to receive motion? With all due deference to other people's opinions, and not desiring to force our opinions upon any one's acceptance, we still submit that it is not.

We insist that it is, as Ganot says, purely a negative property of matter, and is as illogical in its use and application as it would be to define snow as being something not black, not made of whalebone, not good to eat, and not having the property of being agreeable to bare feet. There is no end to definitions, if we accept negatives as such, and their use only blinds the mind to positive facts and just conceptions.

AN INEXPLICABLE POWER.

In Dayton, Ohio, on the 17th of Feb., a terrible boiler explosion took place at the works known as the Western Machine Shops, making a complete wreck of the works, killing five persons, and seriously injuring many others.

The Coroner's jury, after a full investigation of the facts in the case, found that the cause of the explosion was from a low stage of water in the boiler, the result of negligence on the part of the engineer in charge.

We learn that Mr. Fetters, late official inspector of boilers for the district, had, in a conversation with the foreman of the works, pronounced the engineer incompetent, and too careless for such a post. The foreman stated that he was afraid of the concern, and had several times complained of the matter.

The boiler was a nearly new one and in excellent order.

An intelligent engineer sends us now an article called forth by this accident, clipped from a paper the name of which is not given, entitled "An Inexplicable Power," which is really a curiosity in its way, and we therefore give it entire.

"A number of engineers insist that there was inexplicable power in the atmosphere on Thursday afternoon, which prevented boilers from operating properly, that they were unable to account for. They found it impossible to run their engines evenly. They either got too much steam, or not enough, and there was difficulty about the working of the pumps; and they were not able to account for it. There are times—these men affirm—when boilers will explode without any apparent cause, despite the most careful labor by the most practical engineers to be found anywhere. We conversed with several practical engineers, yesterday, and they all agreed as to the strange influence to which we have referred. 'What is it?' we inquired of one. 'Why, it's in the air,' he replied, 'but I can't explain it. I can't run my engine even: for a few minutes steam is generated too fast, and that which escapes from the valve gets blue as blazes, and makes things fairly sing again; and it's really not safe. Then, suddenly the water gains on me, and, although there's a good fire, it appears to be impossible to generate steam; it won't rise, do the best I can with it. Now, the engine is in excellent order, and the pumps work like a top, and there is nothing in the machinery to induce this condition. I think it must be in the air. It was just so Thursday afternoon, and I worked with my engine for half an hour, after dinner, and getting discouraged, I drew my fires to let the boiler cool, so that I could have a fair look at things. I hadn't been out doors a minute until I heard the explosion at Taylor's. I knew in a minute what it was. If I'd kept up my fires five minutes longer, I'd been blowed to bits—I *know* it. There are certain times when an engineer feels that there's an influence at work in his boiler which he don't understand and which he is powerless to control. An engineer who don't know and feel this, will explode a boiler. There may be a shade of superstition in this, but the speaker was in real earnest."

We are able to give a full exposition of this inexplicable