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(Illustrated articles are marked with an asterisk.)

VIS VIVA AND INERTIA.

The exact import of the terms "vis viva" and "inertia," as understood by writers on physics, is difficult of comprehension by ordinary minds, and difficult to explain clearly when comprehended. An engineer of some note once remarked to us, "I know exactly what *I* mean by 'vis viva,' but I find it very difficult to tell it." We do not propose to here enter upon an elaborate discussion of the doctrines of "vis viva" and "inertia," but merely to notice some recent opinions published in the American reprint of the *London Chemical News*, and also a paper by Professor Henry Morton, on the "Resistance and Transmission of Motion," published in the *Journal of the Franklin Institute*.

Prof. Morton charges that the subject has been inadequately treated by some even of the highest authorities, an opinion with which we perfectly coincide. He says, "we say and know that 'vis viva,' or work done by a moving body, varies with the square of its velocity, while we know, by our previous reasoning, that the force expended in giving it that velocity, only varies with the velocity itself. Thus, the force of gravity will give a falling body a double velocity in a double time, during which it must have exerted a double force upon it. Here, then, we have a double force doing a quadruple work. Is this because, by some wonderful and recondite property inherent in 'velocity,' the double power has been indued with an again double efficiency? Many writers leave us to think so; but we, on the contrary, believe that the work done *only seems to increase* more rapidly than the power implied in the increased velocity, by reason of a *loss of efficiency* in the resistances, in the overcoming of which the 'work' consists, and in fact, that work in this sense, is no true measure of force."

This argument is most forcibly and clearly expressed, and is further sustained by reasoning and illustrations which evince close thought upon this abstruse subject. We would be glad to notice this able article more at length, but want of space compels brevity.

The *Chemical News* says, the statements in the works on physics in regard to "vis viva" and momentum, are in its judgment, not sustained by reason or experience. It denies that the power required to maintain a train or a ship in uniform motion, varies as the square of the velocity, and asserts that there is really no such mathematical relation, and there is no close approximation to it. It asserts, moreover, that the case of a ship is so different from that of the train, that many engineers, who strive to measure facts on a procrustean bed of simple mathematical formulæ, represent that the power required to drive a ship varies as the cube of the velocity; and and no experienced engineer will say that within ordinary limits of speed four times as much power is ever required to maintain a train at double velocity. It sums up the case by stating that as it understands the subject of "vis viva," it relates only to change in velocity, and does not apply to the maintenance of a uniform velocity after it has been once attained.

These papers are an index of the effort which thinking minds are now making to disencumber themselves of ideas originating in the old notion of occult force. The terms, "vis viva" and "inertia," were born of that notion; as their parent may be said to be at the last gasp, we say let them die also.

As soon as we shake ourselves free from these clinging errors, and discard the illogical language they have imposed upon us, we shall find our way totally unobstructed; we shall have "cleaned our path from briars." We shall have to come down at last to the simple fact that *motion is force, and force is motion*, that is, so far as the human mind is capable of comprehending force. Motion can only produce an equivalent amount of motion, and hence the only measure of an existing motion is a previously existing or co-existent motion. When we get on to this plane we have got out of the slough of metaphysics and are on solid ground.

HORTICULTURAL PROTECTION.

The proposed granting of patents for new horticultural varieties is meeting with some opposition. The *Evening Post*, in an answer to a correspondent upon the subject, arrays itself with the opposers of the measure. This correspondent, who signs himself "Præsidium," gives some quite valid reasons for granting such patents.

The *Post*, in its editorial, in discussing the subject, restates these reasons in a very uncandid manner. It says: "'Præsidium' presents three reasons for patenting garden products. First, because the author of a book has a copyright, and the inventor of a machine may obtain a patent, therefore the owner of a garden in which any plant may grow which he considers new, ought to have the exclusive right to cultivate that plant." This, after the previous remark, that "respect for the very worthy gentlemen who have devised and now support the plan, demands that both Congress and the public shall give their case a candid hearing," surprises us somewhat. What is claimed by Præsidium and all others who favor the granting of horticultural patents, is not that *because* copyrights are granted to authors, and patent rights to inventors of machinery and devisers of new chemical processes, they should also be granted to cultivators of new varieties without regard to the merits of the case. They claim, what the *Post* grants in a subsequent paragraph, that "it is true that the work of the gardener is often of a highly intellectual and scientific character. His selection of varieties for a cross, his devices in the treatment of his plants, with reference to soil, temperature, and all the varied circumstances of culture; his ready discernment of valuable modifications of every kind, and his ability to develop and strengthen them; all these require powers of a high order—powers which deserve a rich reward."

Is the *Post* ignorant that new varieties of value are more rarely produced by accident than are mechanical improvements? If so, let it study awhile the works of Darwin or Randall, and post itself in the mysteries of reproduction. It says the intellectual labor of the horticulturist, is analogous to that of the scientific investigator and discoverer, rather than to that of the practical inventor and producer. It was rather hard on the "analogies," which it characterizes as "Præsidium's stronghold," but it sees none between the work of the inventor and that of the scientific investigator. Evidently the *Post's* highest idea of an inventor is a man who whittles until he, by accident, gets his stick into a shape that suggests a possibility, and having got the idea of the possibility goes through a series of tinkering till he gets, if not what he sought, something that can be patented. Its idea of the production of new varieties is scarcely better, being, as near as we can infer from the article in question, that they can be obtained, *ad libitum*, by accident. Now any man who has grown up among flowers and fruits, and is aquainted with the laws of their growth, knows better than this. He knows also that within certain limits, judicious selection will enable him to approximate to a type previously determined upon, notwithstanding the *Post's* dictum to the contrary, and that it is as Præsidium claims, "a complete and exclusive expression of his inventive thought."

We have already expressed our opinion upon the desirability and practicability of granting such patents, and although our esteemed cotemporary deems it as absurd as would be the issuing of patents "upon mathematical processes, upon chemical affinities, upon new planets discovered by astronomers, or upon new laws of life announced by physiologists," we fail to see any grounds for so considering it. Indeed, if mathematical processes, new plants, or new laws of life, could be made to pecuniarily reward their discoverers, by the granting of patents upon them, we should be glad to see their labors thus recognized.

MECHANICAL TOYS AS A MEANS OF PRACTICAL INSTRUCTION.

He who will introduce toys with the double object of amusing and instructing will be a benefactor to the race. We are aware that many of the popular toys now in use, are based upon mechanical laws, and, in a degree, illustrate mechanical facts; but this elucidation is not a primary or principal object in their construction, and can be found generally, only by a close study or a partial dissection of the toy. It is not apparent to the casual observer; indeed, the object seems to be to conceal the mechanism and exhibit only the result, tempting the inquiring mind—one that likes to understand the why and wherefore, that "seeks to know where faith should trust"—to copy the example of the boy who burst the heads of his drum to see where the sound came from, or ripped the bellows to find the source of the wind.

From the great steam man to the flying top, from Maelzel's antomaton chess player to the pasteboard acrobats and dancers, the source of power and its modes of transmission are concealed as much as may be. Yet this is the best, most valuable, most interesting exhibition of the device. Concealment is not knowledge; mystery is not wisdom.

The zoetrope or "wheel of life" is a play upon the organs of vision, a valuable exemplification of the science of optics. As such it is amusing, and bewildering. But how valuable it would be to show the action of machinery, to illustrate mechanical movements. A machine or its parts might, by its use, be presented in actual, or rather apparent motion, showing not only the parts of the machine and their relations, but also their action. Why could not the principle of the zoetrope be extended to exhibit, simultaneously to every individual of a large audience, the movements of machinery? Certainly here is room for invention, or, at least, improvement. This toy might be made a valuable aid to impart scientific and mechanical knowledge. The lecturer who first succeeds in introducing the zoetrope to his class, or audience, to illustrate mechanical movements will inaugurate a profitable and valuable means of imparting knowledge. These suggestions are worthy the attention of our inventors.

DETERIORATION IN THE MATERIAL AND WORKMANSHIP OF MANUFACTURED ARTICLES.

We have no sympathy with those who are perpetually bewailing the growing degeneracy of the race and regretfully mourning the "good old times," but, in one respect, at least, the facts give reason for their animadversions of the present compared with the past. The honor of the manufacturer is too often made entirely subservient to his avarice. Articles of common and daily use are made to sell, rather than to last; sham and cheapness are made to take the place of reality and worthiness; paint and putty are used to cover the lack of painstaking and patience; even labor-saving machinery is made to contribute its quota to the revenues derived from the practice of sham. The commonest articles of household use are shams compared with those made by our fathers.

Tin ware will not stand scouring. The brilliant array of tin vessels, once the pride of the housewife, is not readily attainable. The iron sheet, thin as vanity, is slightly washed with a pewtery solution that, always dingy, wholly disappears in a few weeks' use, and the cup, kettle, or pan shortly becomes a sieve, wholly worthless. In wooden ware it is no better. The pail or bucket is made of unseasoned or knotty lumber, bound with hoops of iron foil, and painted with a mixture of ochre and benzine, or washed with some earthy pigment dissolved in water. The tubs fall to pieces unless kept filled with water; the trays and mixing bowls are carved from green wood that splits after a few months' exposure to the kitchen atmosphere. Brooms are bound lightly with rotten twine, instead of being well secured with lasting wire; a cleanly housewife will use one up in a week. Blacking brushes are stuck together with glue and brads; the boots blacked with them bristle like the porcupine.

In the article of furniture—common furniture for the kitchen and dining-room—it is still worse. The chairs are a delusion and a snare; they are built for a race of pigmies, and if they hold together during six months' use the first removal from one habitation to another makes them a wreck. Tables are skaky in the legs, or have lumbago or spinal complaint their backs diversified with prairie scenery, a rolling surface. Bedsteads when once unjointed object to resuming their original fair proportions. The drawers of bureaus recede from the frame and laugh at the impotency of the lock bolt.

And so we might go on indefinitely, and give many other illustrations of the endless variety of shams, sham in material, sham in making up, and sham in appearance. The picture is not overdrawn. Let any one look back twenty or thirty years, and call to mind the Lares and Penates of his father's house, comparing its "fixings" with those now made, and he will see that the times have changed. The furniture bought by the newly-married couple, witnessed the gambols of a large family of children, and served to assist them in their life-start when grown up. New tin ware came at rare intervals, usually the result of the housewife's careful saving of worn-out rags. The advent of a new water bucket or wash tub was an event in the household; they were made to last, intended for use, and they fulfilled their destiny.

We do not believe that the making of money should be the highest motive to actuate the manufacturer; a reputation is really valuable, and in time it pays pecuniarily. We could point to a manufacturer of tin ware who, for twenty years and more, during which he has carried on his business, never allowed any article to go out from his concern which was not, in all respects, first class. He gets good prices, and has a steady custom, which has secured him wealth—wealth honestly earned. Is it not to be supposed that he values his good name as much as his dollars? Is it not as much a source of satisfaction as his accumulations of wealth? When honor shall guide rather than sordid avarice, when a "good name shall be chosen rather than great riches," we may hope a return of those "good old times" when honest workmanship was the workman's best recommendation.

THE CINCINNATI SUSPENSION BRIDGE.

(*See Illustratton on preceding page.*)

Suspension bridges are of very remote origin. One mentioned by Kirchen, still in use in China, was built, according to tradition, in the year A. D. 65; it is 330 feet long, a roadway of plank supported by chains. Rope suspension bridges were built by the ancient Peruvians, and they have been used in Europe. The first iron suspension bridge was built in 1819, across the Tweed, at Berwick-on-Tweed, by Captain Sir Samuel Brown. It was supported by chain cables, six on a side, and its span was 449 feet. The same engineer constructed the Brighton chain pier and the bridge at Montrose. The former was built in 1823, having four spans of 255 feet each; the latter was finished in 1829, and nine years afterward was destroyed by a hurricane. The Menai suspension bridge was built by Telford in 1826. Its span was 580 feet, and hight above the water 102 feet. A violent gale produced such an oscillation that the chains were dashed against each other, and the heads of many of the bolts were broken. The chains were similar to those used on lathes, planers, etc.,