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WHAT KEEPS SOLID BODIES HEAVIER THAN WATER SUSPENDED IN A RUNNING STREAM?

The question here propounded is one of more practical importance than at first sight it may appear. As the sole object in increasing the velocity of the flow of water in rivers by means of dikes and other appliances is to enable the water to keep suspended, or, not to beg the question, to enable the solid matters to remain suspended in the water, so that they will not deposit in the form of bars, it becomes important to be able to ascertain the precise amount of narrowing and straightening that will secure the desired velocity; and the question with which we have headed this article is certainly important in deciding the question of velocity.

To use the words of an able cotemporary, *Engineering*, in an article entitled "Fluvial Abrasion," contained in its issue of June 25th, "Velocity alone is needed to convert half a gallon of shot and half a gallon of water into a plumbeous porridge; indeed, lead, or anything, however heavy, will swim in water if the water only runs sufficiently fast."

Engineering goes on to criticise the views of one of its correspondents in regard to this subject, but in our opinion it makes one rather serious mistake, especially as in the article referred to it assumes the *rôle* of "philosopher," which it plainly tells its correspondent he is not, although an "able and conscientious engineer." It says, "Mr. Login arrives at what we think must be an erroneous conclusion in deducing from various premises that a certain amount of the energy of running water is absorbed or expended in carrying with it solid matter in suspension. In first putting this matter into motion, power is unquestionably abstracted from the water; but as soon as uniform flow is established the solid matter flows in obedience to its own gravitation, neither receiving from nor imparting to the water any power whatever.

"Its tendency to continue its onward motion is sufficient to overcome gravitation, and as it moves with water of its own velocity, it is in equilibrium 'fore and aft,' and thus it moves on with no resistance whatever, unless it be argued that its rate of advance is less than that of the stream. If so, it would drop at once, and the conditions of flow would cease."

If this be philosophy, or if the assumption that uniform flow can be at some time fully established be not begging the question, then have we much left to learn in the elements of physics and logic.

Let us examine this singular proposition in the light of the following well-known and admitted natural laws.

1st. If two or more forces act upon a body at the same time each of these forces produces the same effect as if it acted alone.

2d. The quantity of motion imparted to a body by a constant force is in proportion to the time of the application of the force.

3d. If two forces act simultaneously upon a body in different directions not opposite, it will move in the direction of neither, but in a line between them.

A bed of a river is an inclined plane down which the particles of water roll. If it were perfectly smooth there would be no friction and consequently no wear of the bottom, but as the bottoms of all streams are more or less rough, the projections receive the force of the descending water, and, if the current be strong enough, are forced from their beds and either rolled along the bottom, or, if the impetus is strong enough, are carried out on a line nearly parallel to the base of the inclined plane into the stream. When this has taken place gravity acts upon the body, not in a line parallel to the inclined plane, but in a line perpendicular to its base, which tends to draw the body down to the surface of the inclined plane again by a *constant force* equal to the difference between the weight of the solid floating body heavier than water, and the weight of an equal bulk of water. What counteracts this tendency during any period of time if not the motion of the water? And as the overcoming of the action of a constant force implies a constant exertion of some other force, how are we to escape the conclusion that a constant demand is made upon the momentum of the flowing water to keep stones or sand supported in a current?

The motion of the water obeys the same laws as those of other bodies rolling down an inclined plane; water being practically homogeneous, no part of it seeks by its own gravity to regain the surface of the plane. But a stone carried along by the force of a stream is constantly making this effort. Something prevents it and that something can be nothing else than the water. If stones, or sand and water, were flowing downward by the force of gravity alone in a vertical line, all would move together (not taking into account resistance of the air) at equal velocities for the same points in the line of descent. But in no other case could this occur. As soon as the stream is inclined the heavier body begins to seek the bottom of the channel, and is only prevented from reaching it by absorbing motion from water flowing *more rapidly in a line parallel to the bottom.*

Thus the stone may be said to receive, the moment it attempts to move toward the bottom, an infinite number of kicks from the particles of water which it must check in their flow in order to reach the bottom. It is the game of football repeated; the ball is kept flying, but it takes power to do it.

We have intimated that the speed of solid matters heavier than water must of necessity flow less rapidly in a line parallel to the bottom of the channel than the water which floats them. Many have witnessed the butterfly trick performed by the Japanese jugglers in their exhibitions in this country. It illustrates this truth exactly. Pieces of colored tissue paper are folded to represent butterflies, which, by means of currents of air adroitly produced by fans, are made to float or alight and appear to sustain themselves at the will of the performer. It is a very ingenious and amusing feat, but the same principle is involved in it as in the "plumbeous porridge" of *Engineering*. The heavier bodies are only sustained by the momentum of the more rapidly flowing light fluid.

Again what is the "tendency to continue its onward motion" which *Engineering* says is sufficient to overcome gravity but an impulse received from the water. But admitting for the sake of argument that it has such a tendency in and of itself (its inertia perhaps is meant), the direction of such a force would be in a line parallel to the bottom. On what new principle of physics is it asserted that a force acting at nearly a right angle to the force of gravity will counteract gravity? A proposition at once so entirely void of any foundation in the laws of force and motion, and so feebly sustained by argument will surprise the readers and admirers of our esteemed and usually accurate cotemporary. Does it not also tacitly admit its error when it says that "anything, however heavy, will swim in water if it only runs *sufficiently fast.* Is this not equivalent to saying the heavier the body the greater the velocity in the stream needed, not only to start it, but to *keep it up after it starts*? And what ground is there for asserting that such a body would sink "at once" should its velocity ever become less than that of the water? Let *Engineering* tie a cast-iron plate to a string and then throw it upon a very rapidly flowing stream, holding on tight to the string, and report the result. The experiment will be nothing more than flying a water kite.

ORNAMENTAL PAINTING OF BUILDINGS.

Why it is that the American people run so much to the somber colors in the painting of houses and outbuildings, is an æsthetical question we leave for others to discuss. The general lack of taste generally displayed in the selection of tints is, however, only too palpable. One has only to take a ramble through one of our cities to demonstrate this fact. Rows upon rows of dull and dismal looking dwellings may be met with, painted dark-brown or a dirty-looking drab, with blinds of a color suggestive of nothing but mud.

The combinations of color frequently met with are positively hideous. There is a drab colored house which we are obliged to pass freqently, with sky-blue window casings and blinds, and a sort of balcony in front with an utterly unheard of color, one might suppose to have been compounded of all the pigments scraped from the bottoms of the pots in some painter's establishment for a year, ground together into a dauby, dingy hue altogether indescribable. This house is enough to throw a man of good taste into spasms of disgust. Nor is it a solitary instance except in the depth of depravity to which the taste of its would-be decorator has sunk.

Summer relieves the eye somewhat when its soft green covers the earth, but when winter comes these abortions of color stand out in revolting deformity. Here is a frame house which the painter has attempted to make look like a brown-stone, and in doing so has made it look like a prison house of woe. There is what would have been a pretty little cottage if it had not been spoiled by Spanish brown. Back of it stands a carriage house of a leaden blue color. Yonder is a large mansion of brown stone, stately in its proportions and with a well designed front, the effect of which is spoiled by interior blinds with white frames and yellow slats.

In rural districts these defects are carried still further, so far as outside work is concerned, while the inside work is for the most part left bare and plain. Where any attempt at decoration is made, however, neutral tints without meaning are generally employed.

Nothing like attention to a general tone, and no reference whatever to the colors of carpets or furniture, is to be discovered in ninety-nine cases out of a hundred. All is a mass of incongruity from beginning to end.

The grossness of the fault being admitted, to what is it chargeable? In part to the bad taste of people at large, but most to the imperfect knowledge of painters, who, as a class, are sadly deficient in the knowledge of harmony in color, and whose instruction is mainly confined to grinding colors and manipulation of the brush.

If house painters could only be made to realize the value of the study of color, and to understand that the really great in the art are so chiefly because of their superior knowledge in this respect, improvement might be expected. There is no longer any excuse for ignorance. The researches and works of Chevreul, and others, have provided the necessary means whereby any intelligent painter may obtain the proper instruction.

Much doubtless depends upon natural talent in this as in other arts; but still we feel justified in asserting that in this country, at least, the house painters are far more deficient in the knowledge necessary to a high degree of skill than mechanics in other occupations. We do not suppose all house painters will become artists even with the knowledge which all ought to possess, but it is certain that no one will ever perform superior work without it.

LABOR-SAVING MACHINERY AND CO-OPERATIVE LABOR.

The value of labor-saving machinery is a subject which we have often discussed in these columns, and we should not now return to it were it not that we sometimes meet the assertion, that the extended use of labor-saving machinery has created a disability on the part of labor to compete with capital. We cannot suppose any one in this enlightened age will claim that anything calculated to constantly put power into the hands of one class, at the expense of another, not to say a very much larger class, could ultimately lead to anything but tyranny on the one hand, and abject servitude on the other.

The condition of labor, at the present time, is, we maintain, better, on the whole, than at any previous time in the history of the world. Slavery and serfdom are nearly extinct throughout the civilized world, and if wages be estimated, not in dollars, but in comforts of life received as the reward of industry, they are higher now than at any previous period. Of course, we do not, in this statement, take into account any temporary difference which might be found upon comparing the prices of to-day with ruling prices existing a few years since. What we wish to make plain is, that if a mean be struck, from the commencement of the Christian era to the present time, it will be found that labor has made much greater progress than capital. It will further be found, that the most progress has been made since the introduction of labor-saving machinery, and we assert, that such machinery has been a propelling power, not a resistance to be overcome in this progress.

The peculiarity of the effect of labor-saving machinery, of greatest importance in a social point of view, as affecting the status of classes, is the local concentration of labor, at the same time that it subdivides it into departments. Few manufactures now exist in which more than a part of the article produced is made by a single operative. In the majority of cases, the thing made passes through many hands before its completion. In order that the one article thus manufactured by the help of many workers can be made economically, it is necessary that the workmen should be brought together. This coming together is an element of social power which labor did not possess before the introduction of labor-saving machinery.

The result is association to protect mutual interests, and capital has latterly found it a very difficult matter to usurp undue authority since these associations have fully developed their power. It has enough to do to hold its own.

Labor-saving machinery is the only thing that renders co-operation possible in the mechanic arts. This kind of organization is yet destined to play an important part in the history of civilization.

If these facts are true, and we think them indisputable, labor has not suffered disability, but, on the contrary, has derived increased power to compete with capital from the use of labor-saving machinery, and those who think otherwise base their opinions, we think, upon a too narrow view of the subject.

ELECTRO-PLATING AND GILDING.

Every year adds to the general demand for electro-plated goods, and the experience necessary to produce them in the most perfect manner. The manufacture is based upon what has received the scientific name of electrolysis, that is, the decomposition of compound substances by means of the electric current. The current may be generated, either mechanically, with the ordinary friction machines, or chemically, as in the various galvanic batteries in use. The substance thus capable of being decomposed is called an electrolyte. Every electrolyte contains two or more elements which may be divided into two groups: those which are attracted to the positive pole of the battery, and those which go to the negative pole. These two groups are called *ions*, and those which move to the positive pole are called *anions*, while those which move to the negative pole are called *cations*.

To illustrate this, suppose the substance to be decomposed is sulphate of copper, in solution, and an electric current to be passed through it. Sulphate of copper is composed of copper and sulphuric acid, the latter of which is composed of sulphur and oxygen. Copper is a cation, hence it will move to the negative pole of the battery. Both sulphur and oxygen