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(Illustrated articles are marked with an asterisk.)

Importance of Advertising.

The value of advertising is so well understood by old established business firms, that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 40,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

WHAT IS A MACHINE?

We venture to say that nine out of every ten mechanics would be puzzled to give a satisfactory answer to the above question. We mean, by a satisfactory answer, such a definition as will clearly apply to a machine and to nothing else. This is no proof of lack of intelligence on the part of mechanics, since no less a lexicographer than Webster has failed to give a good definition of the term. At least one out of ten mechanics should be able to give as good, if not a better one.

Webster says a machine is "in a general sense anything used to *augment* or regulate force or motion. The simplest machines are those usually denominated the six mechanical powers, namely, the lever, the pulley, the axis and wheel, the wedge, the screw, and the inclined plane." "More properly, a machine is a complex structure, consisting of a combination or a peculiar modification of the mechanical powers."

Now the first of these definitions is simply absurd, since we know that no machine ever augmented or diminished a force, considered as a force, or ever regulated anything but motion. The second is defective because, to be defined by it, a machine must include all the mechanical powers above enumerated, and cannot include more. But we need not say to mechanics that endless chains, and belts, and flexible cords, are parts of some machines.

We shall find, if we succeed in giving a better definition, that we must get down to a broader foundation for it. We cannot describe machines in general so as to convey any idea of what is common to all of them without first clearly perceiving what is accomplished by the use of any machine. Practically, moving matter is all the force with which machines deal. Falling water, expanding steam, the movements of animals, air currents, molecular motion of magnets converted into mass motion in the armatures, etc., these are the moving agents of machinery. The direct application of what is called abstract force has never yet and never will be made to move a machine.

Beginning, then, with matter in motion, and applying this motion to machinery, let us see what is and what is not accomplished. First we find that the amount of motion applied, that is the weight of the primarily moving mass multiplied into its velocity, is not affected in any way by our machine. When we have summed up the amount consumed in friction, the momenta of the moving parts, the amount consumed in giving to the machinery its standard velocity, that consumed in overcoming resistance of the medium in which the machine moves, and that which is finally converted into useful work, we find the sum always equal to that part of the momentum of the primarily moving mass which we have used to impel our mechanism.

But we discover that whenever we use machinery, we change the direction of motion. If we throw a block of wood upon the bosom of a river, the block will be carried along to the ocean, and a certain amount of work will have been done. The wood, however, has not been an instrument in the accomplishment of the work; it has only been passive, acted upon, but not transmitting motion. It is not a machine. Let us make this block a means of transmitting the motion of the stream to other matter, and it becomes a machine. In order to do this we restrain its motion at some point,—say its center. It begins to revolve, because its movable exterior still is actuated by the current, while its central axis is kept stationary. It is now an undershot water wheel, and capable of performing work.

Let us try to do some work with it. The simplest thing we can do is to cause it to raise a weight on its ascending side. We have here the conversion of the horizontal motion of matter into vertical ascending motion. Strictly speaking, our machine has therefore only conveyed motion from one moving mass and imparted it to another *in a different direction*. And this being solely what the elements of machines do, our definition of a machine is, an instrument, or a combination of instruments, for transmitting power from one moving mass to another in a different direction. Whatever complex results may be produced, this, and this only, is the common characteristic upon which a definition can be based.

POISONING BY ANTIMONY.---THE WHARTON TRIAL.

An important trial, for an alleged murder by antimony, recently pending in Annapolis has attracted unusual notice in consequence of the conflicting character of the testimony offered by scientific men summoned as experts. One of the witnesses testifies in the most explicit terms to having found antimony, but, when cross-questioned as to the methods pursued for arriving at this knowledge, he gives such tests as are no longer regarded as of any value by chemists, and his testimony is flatly contradicted by experts who have kept up with the progress of modern research and are familiar with the best methods at present employed for the detection of poisons. "When doctors disagree, who shall decide?" We suppose the jury in this case, but upon what principles they are to weigh the evidence and determine who of the numerous learned men are to be believed and who discarded, is not stated. We suppose that nobody outside of the jury box, and we trust nobody in it, will be deceived by the mist and obscurity that the lawyers have attempted to throw around a very clear subject by dragging certain ignorant men upon the stand to take the position of experts. All of the chemists of learning and experience would agree, but it would be easy enough to find numerous charlatans who would testify to anything that was required of them. It is not a little curious that antimony should have been the occasion of bitter controversies ever since it was first made known. It was first described by Basil Valentine about the time of the discovery of America by Columbus. This worthy monk, residing in Erfürth, Germany, was wont to try numerous scientific experiments between his *aves* and *paters*, and is reported to have given some antimony to the convent hogs for the purpose of fattening them. The animals gained in flesh amazingly, and the benevolent father thought that it would be a kind act to repeat the experiment upon his lean and fasting brethren. This time the result was not so favorable, and several of the priests died. "What will cure a hog will kill a monk" was the verdict of the time, and the metal which caused the mischief was called *anti-moine*, death to monks; and we now call it antimony. Notwithstanding the unfavorable issue of Valentine's prescription, antimony became one of the most popular medicines of the day, and its use, or rather abuse, was carried to such an extent that in France in 1566 a special edict was promulgated against its employment as a medicine, which law was not repealed until after the lapse of a hundred years. Very few of our elementary bodies have been subjected to so much study and investigation as antimony, and one would suppose that by this time all of its properties and relations ought to be pretty thoroughly understood; and they are fully known to chemists of any claim to the title of scientific men. As the salts of antimony are frequently employed in medicine, and can consequently be purchased without exciting suspicion, they have long been the favorite agents, in the hands of evil disposed persons, to be used for poisoning. No doubt many persons have been the victims of this poison without suspicion; and in most cases where suspicions have been aroused, and the persons who gave the medicine have been tried before the courts, it has not been found very difficult to acquit the accused, chiefly on the ground that the deceased may have taken the antimony as a medicine. In the case of arsenic this remedy does not hold, as that dangerous substance can hardly be called a medicine. One of the most remarkable cases of the accidental employment of a large quantity of a salt of antimony occurred in Göttingen, Germany, in 1861, on the occasion of the annual fair in that city. It transpired on investigation that a baker had used a large quantity of tartar emetic instead of saleratus in mixing flour for a peculiar kind of gingerbread much coveted in that region of country. The number of persons poisoned by this cake was so great as to bring about a thorough judicial investigation which led to the discovery of the above facts. In 1865, Dr. Britchard, of Glasgow, Scotland, poisoned his wife and mother-in-law by administering overdoses of tartar emetic; and in the famous case of William Palmer, there was also much talk of antimony.

It is not necessary for us to follow the evidence adduced by the prosecution at Annapolis to prove that death was caused by antimony, as the daily press has given full details of the trial; but it may be well to mention some of the properties of antimony, together with the tests that ought to be applied for its detection. A preliminary step in all such investigations is the previous examination of all of the utensils and re-agents to be employed. It often happens that re-agents, purchased as chemically pure, are on examination shown to be largely contaminated by foreign substances. This is particularly the fact with such common chemicals as sulphuric and hydrochloric acids. Even ammonia, derived as it now is from the dirty refuse of gas works, is nearly always impure, and liable to occasion disturbances in some of our most important remedies. The apparatus used in a search for poisons should be absolutely new and clean. After taking all of these preliminary precautions, the chemist is in condition to enter upon his examination. The modern chemist would be apt to make an early test with the spectroscope. This instrument reveals, with unerring certainty, the least trace of any volatile substance, and is invaluable in all cases of suspected poisoning. Antimony gives a multitude of brilliant rays more numerous than those afforded by the spectra of other metals; the most prominent lines are to be found in the orange, green, and violet portion of the spectrum.

It is somewhat remarkable that in the recent Annapolis trial so little stress should have been laid upon spectrum analysis. After the spectroscope, usually follows electrolysis, or the decomposition of the substance by electricity; in the case of antimony the product obtainable in this way depends upon the form of the experiment, strength of current, etc. Sometimes we find the metal at the negative pole in a crystalline condition, then again gray and hard, with a specific gravity of 6·6. The amorphous antimony obtained by electrolysis is characterized by its explosiveness on percussion. Passing from the action of light and electricity, the chemist would take up the tests described in so many books that we wonder where some of the Annapolis experts found the methods practised by them. Even traces of antimony can be found by any of the following methods:

1. By passing sulphuretted hydrogen through an acid solution and subsequent comparative tests to distinguish the precipitate from arsenic. 2. The copper test. 3. The Marsh test, to which however, in recent times, many objections have been raised. In all cases of importance, as in a trial for murder, the metal ought to be produced in court, and the specimens obtained, by the reactions described above, ought to be also kept for exhibition. The spectrum analysis would have to be taken on faith, unless the court room was provided with conveniences for throwing the lines upon a screen. Our knowledge of antimony is so accurate, and the researches into its propensities extend over so many centuries, that ignorance just now is wholly inexcusable, and all wrangling unnecessary.

We only need to turn to any standard text book on chemistry to obtain all the information that we may require on the subject.

HEALTH AND DISEASE.

In glancing over a medical journal, the other day, we stumbled upon the assertion that the lack of knowledge upon the treatment of cancer is a disgrace to the medical profession. If this be so, how much honor ought to be given to a profession which can neither determine cause nor cure of apparently far more simple diseases than cancer, and of which it may be said that the most intelligent and skillful physicians now cease attempting to cure? We seriously question whether there is one half of the diseases, enumerated in any good work on the practice of medicine, which the best practitioners dream of curing. They simply let these diseases have their course, taking care that nothing except the complaint shall obstruct the patient's return to health. Nature does the fighting with the malady, the physician sees that it is a fair fight, and that the recuperative power of the constitution shall not encounter bad nursing, bad diet, bad air, nor the bad companionship of depressing mental influences.

If you ask a skillful physician what is health, he will glibly run off a formula, of excellent sound and seeming sense. He has another equally well sounding formula which is his definition of disease. Ask him to apply these formulæ, and you will see that, while marked variations from the general standard of health are easy to determine, the precise nature of the variation is, in most cases, as absolutely unknown to him as to the laymen. There are certain characteristics of diseases to the majority of which, when they appear, he gives a name. He says such a patient has the small-pox, another phthisis, another measles, and so on. These names only characterize groups of appearances; they give no clue to the real nature of the complaint.

Notwithstanding what we have said, we assert that the medical profession is worthy of honor; and that no better advice can be given, to a patient who is sensible enough to distinguish between dosing and doctoring, than to obtain in sickness the counsel of a really able physician. For despite all the obstacles which have intervened to prevent accurate knowledge of the hidden characters of disease, there is something known. Physicians are beginning to know how little they know, which is a long stride toward rational practice.

A skilled practitioner, formerly a lecturer in a medical institution, said to us in a recent conversation: "The medical practice of the future is to be essentially hygienic." This statement is most significant. Physicians are gradually relinquishing their faith in drugs, and placing their trust more and more in the recuperative power of their patients. Less calomel, rhubarb and jalap, and more pure, sweet air, more

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