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(Illustrated articles are marked with an asterisk.)

CAVEATS.

Whenever an inventor is engaged in working out a new improvement, and is fearful that some other party may get ahead of him in applying for a patent, it is desirable, under such circumstances, to file a caveat, which is good for one year, and during that time will operate to prevent the issue of a patent to other parties. The nature of a caveat is fully explained in our pamphlet, which we mail free of charge.

EUROPEAN PATENTS.

More than three-fourths of all the patents taken by American citizens in Europe have been secured through the Scientific American Patent Agency. Inventors should be careful to put their cases in the hands of responsible agents, as in England for example, the first introducer can take the patent and the rightful inventor has no remedy. We have recently issued a new edition of our Synopsis of European Patent Laws.

COMPARISON AND RELATION THE ONLY CRITERION OF SIZE.

The "mechanical eye," so valuable in mechanical operations, is educated wholly by the comparison of one object with another; it has no absolute virtue, or power of determining the real dimensions of any object. If it were so there would be small necessity for accurate rules and gages, by which the eye determines any dimensions. Let the most experienced mechanic be shown a piece of say three-quarters inch iron, in connection with other pieces of iron of one inch, and one and a quarter, and of three quarters and less, and he may find no difficulty in determining by his eye the diameter of either one of these pieces, it being considered, of course, that the diameter of some one or more of these pieces are known. Yet let this piece of three-quarters inch iron be shown in connection with bars of from two inches diameter to six inches, and it would puzzle the most educated eye to determine whether the three-quarter inch iron was of that size or whether it was seven-eighths or eleven-sixteenths of an inch in diameter. The reason is that the eye is insensibly misled or diverted from the object to be viewed, or rather is so occupied by the surroundings that an accurate estimate is impossible.

So distance, as all know, interferes with the exact action of the educated eye. No two mechanics, however skillful, will agree, for instance, on the exact size of a cross on a church steeple. Why? because there is no object near by which the relative hight or size of the cross may be gaged.

Yet even when there are means of comparing relative dimensions, it is sometimes difficult to determine size and position. In no case is this seen more plainly than in the work of the proof-reader who wishes to know if a letter is turned. Take the letters S, s, X, Z, and the figures 3 and 8. To the ordinary sight, the lower and upper half of these are identical in form and size; but let the reader reverse them—turn the page upside down—and he will see at once that there is a difference, so great that even the careless reader will be aware of it, although perhaps not able to decide where the discrepancy exists or to point out the remedy. The proof-reader, however, has educated his eye to such a nicety in ascertaining and comparing forms in the relations of contiguous objects that what would escape the notice of others arrests his attention, and he sees at once the trouble without the necessity of reversing the page for the purpose.

There is no fallacy so fallacious, no saying less an axiom, than that one may depend upon the evidence of his senses, especially the one of vision. To use this correctly the eye must be educated, and not only educated, but confined to the observation of a certain set of objects to acquire the skill which is the offspring of discrimination. The astronomer is not a chemist, who can detect the presence of the minutest portion of a foreign element in the substance he examines by the microscope. The sea-going man, used to peering through long distances, would be as much out of his sphere in the watchmaker's shop as a girl would be with the cares of a country on her brain. His eyes are as uneducated to the microscopic niceties of the watchmaker's art, as is the woman's brain to the responsibilities of government.

SELF-EDUCATION.

All men of distinction are self-educated men in one sense. The early possession of what are commonly termed educational "advantages," is of little value unless those who enjoy them have in themselves the elements without which such advantages are worthless. Given these elements and the "advantages" are not indispensable, although valuable. Circumstances have much to do in developing taste for study, which is the common characteristic of all thoroughly educated men. Many a young man who now looks upon the study of books as a dry and irksome task, would, if his attention were fixed upon some subject adapted to his tastes and moderate acquirements, entirely change his views. Without underating the value of proper instruction, the fact that so many men have been able to achieve scientific eminence without it, is sufficient encouragement to such as are perforce deprived of it. To such, and there are not a few among the youth of this country, we offer a few suggestions as to the best course for self-training.

In higher institutions of learning it is usual to say one *reads* Latin or Greek, or mathematics or mechanics, rather than he studies this or the other subject. The word read is here a synonym for study. That is right; to read properly is to study in its highest sense. It is a much more difficult thing to read than most people think. For the most part that which is called reading is mere skimming. It occupies an idle hour by placing a variety of images before the mind in rapid succession, like a kaleidoscope, but like the images of that amusing toy, each is forgotten as a new one is presented; and after all is done nothing remains but a dim recollection of a jumble of colors. Nothing definite, nothing valuable is retained. But, says one, I read for amusement, and so long as I get that, I wish nothing more. To him we reply that our suggestions are not to him, at least until his tastes are radically changed. Only this much we will say to him; he greatly mistakes if he supposes that even the highest degree of amusement is to be obtained in such reading.

We affirm that when a youth has acquired the power to *read his own language* in the full meaning of the term, he is nine-tenths educated. We care not if he has never looked into a work on mathematics, or conjugated a Greek verb. He may know little or nothing of the sciences, but he has acquired the power to know any thing that any other mind can know, because he has mastered the means by which all knowledge is accessible to him—his mother tongue. Not obtained such a critical knowledge of its etymology as he will obtain by a classical course of reading, or of the niceties of grammatical construction; but mastered it in that he holds the keys that will unlock all the storehouses of learning. He is a mental gymnast who, although he has never attempted to raise the heavy weights of knowledge and science, need have no fear that he will fail in his attempts when he essays it.

Young men who are desirous to educate themselves, should select elementary treatises at first; such as treat of their subjects in a familiar manner. Having thus selected, they should set about reading them with the stern determination, not to let a single page, or line, or word, pass uncomprehended. Geographical names should be properly pronounced and the places they indicate carefully located, not on a map merely, but in the mind. Allusions to men and events should be at once followed by research into the histories of the men and the events themselves. The writer of this article once, upon commencing to peruse a volume found before he had got over the first page, that he must read up two or three biographies, and several other collateral matters before he could go on intelligently. Such occurrences will frequently happen, but the labor involved must not be shirked; if labor at first, it will soon become pleasure.

The habit of fixed attention is also of the utmost importance. A wandering mind is essentially a weak mind. If anything is unworthy attention, renounce it altogether, do not acquire that bad habit of at once half listening, and half pondering, so common and so enervating to mental vigor. Remember always, that *to get* is not so important as the *power* to get. Strive to obtain strength of mind rather than many ill-digested facts. Don't swallow facts whole any more than you would your food. Chew and digest. Overloading is as bad for the mind as for the stomach, therefore avoid cramming. Seek to learn the general principles of science rather than the bare details; the details will come upon application of the principles. Cultivate the habit of closely observing everything you see. Every natural thing is worthy the closest inspection. Works of art and mechanical construction are good studies whether meritorious or otherwise. If good, seek to know the elements of their worth; if bad, criticise their faults. If your tastes incline to any particular field of study, let them run. Don't seek to stop them. You will succeed best in that field. Above all, avoid the pernicious habits of listlessness and day-dreaming, and remember that the chief attribute of genius, if there is anything can be called genius, is the disposition to study anywhere and everywhere, with or without book, to think not hap-hazard, but to think fixedly and connectedly upon what you will. You can study while you are working at a vise, or at the lathe, or pegging a shoe but it must be thought that is subject to your will; kept within prescribed bounds, or it becomes the day-dreaming which we have cautioned you against.

Lastly, while we do not condemn indiscriminately the reading of works of fiction, we assert that until you have ripened and improved your tastes by a different class of literature, you can not be judges of what is good or bad in fiction; so that if you read such works at all, you should do it under the direction of some one who is competent to advise you what is meritorious and what is to be avoided.

"GOLD! GOLD! HARD TO GET AND HEAVY TO HOLD."

The above line was written at a time when the sources of gold were less numerous than at present, when fewer men were employed in digging it—when the supply was very much less than now. Notwithstanding, gold is harder to get now than in Hood's time, and still harder to keep when got. The reason for the firmness in the price of gold seems to be a universal topic, just now, among papers devoted to finance. Very little light is thrown upon the subject by the essays which we have perused. The fact that the supply has largely increased, is urged to show that present rates are too high. The collateral fact, that gold is used up very slowly, at best, by wear, losses at sea, etc., is also strongly urged to prove that there must be a large increase in the amount of gold in circulation.

The gold fields of California, Australia, Colorado, Idaho, and Montana, have been successively developed during the last twenty years, and have poured an enormous amount of gold into the general current. Since 1850, one billion of dollars' worth of gold has been mined, yet the relative value of gold to other precious metals remains essentially unchanged.

It was predicted, ten years ago, that the price of gold must become permanently depreciated by the large increase in production. To-day that prediction remains unfulfilled; yet to-day the prediction is as confidently reasserted, as it was ten years ago. The quite general distribution of gold, in mountain ranges everywhere, is an admitted fact. At present, it is only profitable to mine for it under circumstances of comparatively little difficulty, so that many large deposits remain unmolested. New deposits are constantly coming to light, so that the supply annually increases rather than diminishes. Accounts reach us of mines of extraordinary richness in Southern Africa. The mines of Italy are just beginning to pay, while the mines of Frontino and Bolivia seem to give specimens of remarkable richness.

Are, then, the predictions of which we have spoken about to be realized? We think not. We believe that, in 1878, gold will be found to have still maintained its relative value, in spite of the large amount that may reasonably be expected to be taken out before that time.

Briefly, our reasons for this opinion are these: First, gold is a commodity as much as iron, and is subject to the same laws of supply and demand. Second, the demand has increased, in the past, and, we are confident, will increase in the future as fast or faster than the supply. The uses of gold in the arts are increasing in number and extent. Compare the number of gold watches, the amount of gold employed in jewelry, dentistry, gilding, bookbinding, etc., with the same, twenty years ago, and it will at once be evident that the demand has increased without resort to statistics. The population of the world is increasing, and, more important still in its effects upon a demand for gold, is the rapid march of civilization, and the consequent spread of a taste for general ornament, in which gold is so largely used.

Here we have elements of increased demand to compensate for increased supply. Those who only think of gold as currency must of course be misled, in their opinions upon this subject. There is probably far more gold in this country to-day applied to ornamental uses than exists in coin. Nearly all above the lowest walks of life have more or less of it upon their persons and in their houses. So long as this is the case, so long as population continues to increase at its present rate, and civilization advances, so long will gold maintain its standard of value, if indeed it does not rise above it.

EXPANSION OF ICE.

A discussion upon the expansion or contraction of ice by the action of cold is exciting much interest in England, both on account of the subject itself, and the high authorities which are parties in the discussion. Prof. Tyndall takes the ground that it expands. Other eminent philosophers dispute the accuracy of the experiment from which Dr. Tyndall draws his conclusions. The experiment is as follows: Around nicely fitted blocks of ice he places bands of cast iron; upon submitting the whole to the action of a freezing mixture the bands soon burst with a loud report. Those who doubt the correctness of Dr. Tyndall's conclusion, argue that the experiment does not prove that ice expands, as the contraction of the iron is sufficient to account for the bursting of the bands. They further confirm their opinions by the fact that the ice which forms upon the surface of the British American Lakes, often to a thickness of several inches during a single cold night, will, upon the recurrence of severe cold, crack open widely. This is thought to indicate contraction instead of expansion. It certainly seems that the experiment of bursting iron rings by refrigeration is not altogether conclusive of the expansion of ice, still although it may be defective, we are inclined to the opinion that ice does expand as the temperature diminishes. If such should be the case, it appears to us that it would easily be deter-